the OIL AND GAS JOURNAL

JANUARY 2, 1956

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Congress faces big oil agenda

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L.P.G....

Records fall, new ones ahead

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NATURAL GAS...

Another boom year in '56

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New Method for Coating Offshore Pipelines. • p. 70

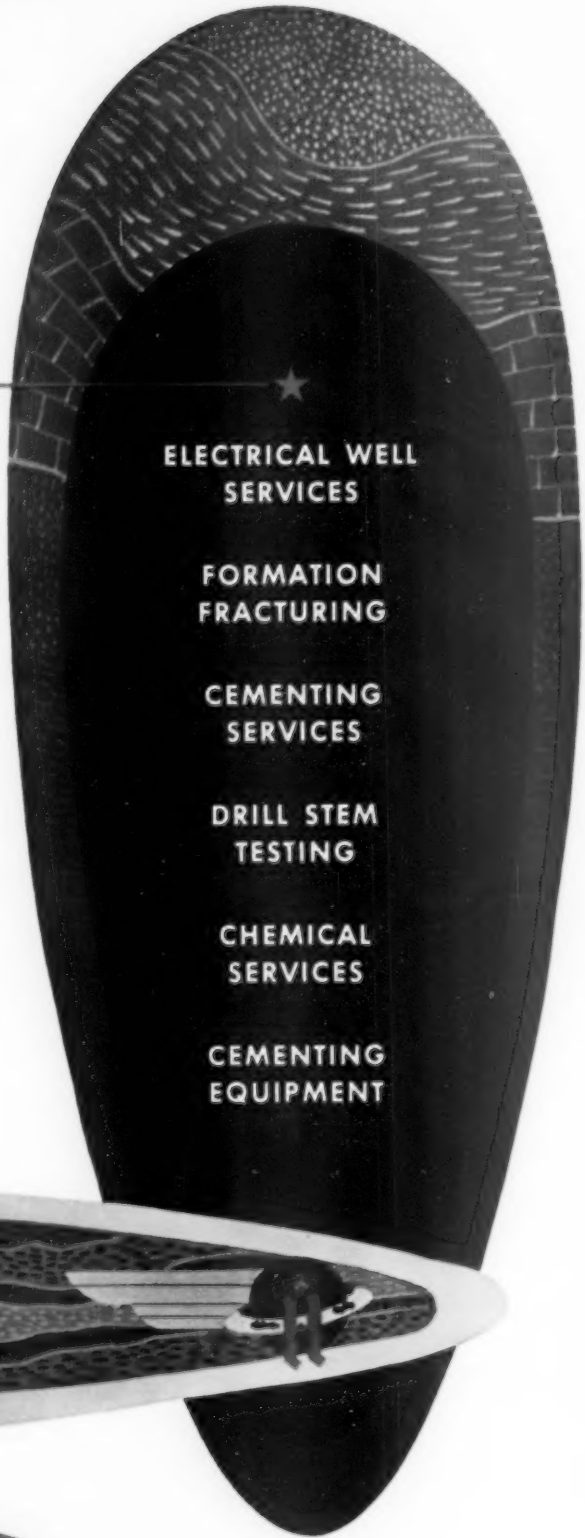
"what's HALLIBURTON doing in all these services?

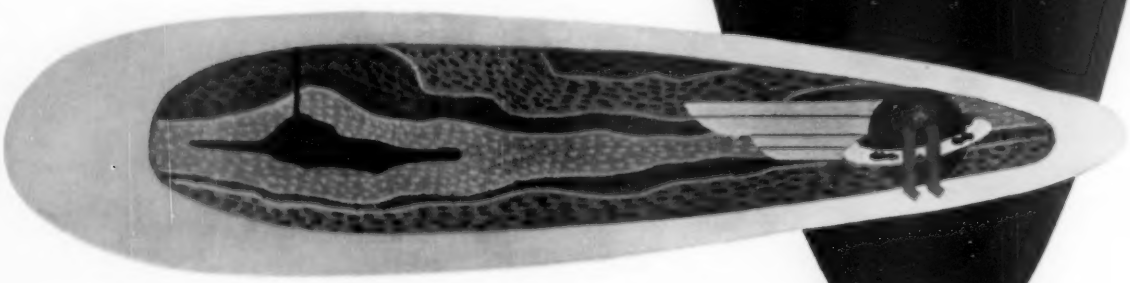
There's a question with a double meaning. Your tone of voice determines the answer. If you're not using all of Halliburton's services you may be asking *why* we offer so many. The answer is—because *all* these services are important, necessary, and closely integrated. Each helps the other put more oil in the tanks.

If you *are* using all of Halliburton's services, you know about our great research program. You'll be asking what Halliburton is doing that's *new*. And the answer is—we are continually changing the old way of doing things. . .constantly improving and developing new tools, techniques, and technology . . . always making every effort to serve you better, day after day.

However you ask the question, Halliburton answers by performing SERVICE . . . service beyond the fee, service above all. And, above all, research is our most important service.

PROGRESS IN SERVICE THROUGH RESEARCH





HALLIBURTON

OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

A glance ahead . . . at press time

These trends will make TOMORROW'S NEWS

Is refining of the future going to include alchemy? It's possible. Researchers aren't planning to transmute base metals to gold, but they have found that sulfur in petroleum fractions exposed to atomic radiation is converted to radioactive phosphorus, which decays or becomes less radioactive fairly rapidly.

Now they're looking into the effects of phosphorus on various product qualities. This is long-range stuff, but something to be thinking about.

Radioactivity well logging is going to get a bigger play in the future. The big advantage—and incentive for development—of this logging method is this: It can make measurements of the formation behind casing and will work in all types of mud or in a dry hole.

A promising technique now being explored is the neutron log, which determines porosity and detects gas-bearing formations. New fields for radioactivity logs are measurement of greatly enlarged bore holes and measurement of formation density.

Current work also may lead to better detectors which will analyze either natural or artificial radiation to determine the type of rock being logged and identify the fluid in it.

Hydrogen treating is catching on so fast that total capacity in this country should exceed 1,000,000 bbl. per day before many months.

This auxiliary process will also extend the function of catalytic reforming by cleaning up marginal stocks to the point where they can be reformed economically.

Internal coating of natural-gas lines is still so new that there is a mixed opinion among engineers of its value in increasing flow efficiency.

Many question whether information gathered to date is conclusive. Some think the decrease in diameter, slight though it is, might offset any possible theoretical gain in efficiency.

No crystal-ballers are willing to get specific yet on just when the gas-turbine automobile will become a major factor in the fuel picture.

In fact, some are extending the date when they think refiners will convert from high-octane gasoline to turbine fuel. The main area of agreement is that such fuels will require a lot of processing for required yields and qualities.

This scotches talk about "cheap fuels" and augments the other problems which must be solved before the gas turbine can become competitive.

The problem of controlling pulsation in compressor-station piping has been whipped by a new electrical-analog method of piping design.

The analog, which may make obsolete present methods of design, was developed by the Southern Gas Association pulsation council and the Southwest Research Institute. It allows complete evaluation of any piping configuration as to its performance under all conditions of operation as well as its effect on compressor efficiency.

The OIL AND GAS JOURNAL

JANUARY 2, 1956 • VOLUME 54 • NUMBER 35

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TECHNOLOGY—OPERATION

Pipelining

New Method for Coating Offshore Pipelines **70**

By P. H. Timothy

Here's the full story on a new rubberized-asphalt-mastic coating for pipelines. Detailed steps are given for coating method.

Pipeline Patrol: A Safer Way to Cut and Weld Main Line **127**

By Hobart A. Payne

This report shows how to replace a section of line without using a cutting torch or welding equipment.

Refining—Processing

Saunders Gasoline Plant Incorporates New Features **80**

By R. L. Lane

Warren Petroleum Corp.'s Saunders gasoline plant in Lea County, New Mexico, has several new features, including dry distillation, two-still system, presaturator, hydraulic-turbine drives, dew-point control, and oil reclaimer.

Delayed Coking and How It's Used **89**

By John E. Kasch and E. W. Thiele

Here's a complete story on the inception, development, present use, and future plans for the delayed-coking process. Latest announced installation of this tested process is that at American Oil Co.'s Yorktown refinery. This unit is described.

Ethylene by Steam Cracking Ethane and Propane **113**

Ethylene can be produced commercially from ethane, propane, and heavier stocks by the steam-pyrolysis process. Improved yields are obtained from any feed stock by adding steam during the cracking process. Yield and cost data are included.

Costimating **119-120**

Foreman's Page **121**

Equipment Design and Operation **125**

Drilling—Production

Lease-Oil Stabilization Pays Off **76**

By C. V. Hornback

Here are the results of tests by Sun Oil Co. in Millican field, Coke County, Texas. Approximately 60 per cent is three-staged, 35 per cent two-staged, and 5 per cent single-staged. Field stabilization increases stock-tank recovery by 3.8 per cent.

Does Your Thread Lubricant Do the Job? **78**

By C. H. Dragert

Much U. S. Oil Comes From Injection Projects **91**

By Lewis Finch, Jr., and F. M. Stewart

About 23 per cent of U. S. oil production now comes from fields in which injection projects are operating.

New Drilling Fluids in the Soviet Orbit **99**

By George Rosu

A realistic picture shows Russian drilling methods to be largely stopgaps and inferior in many cases to western methods.

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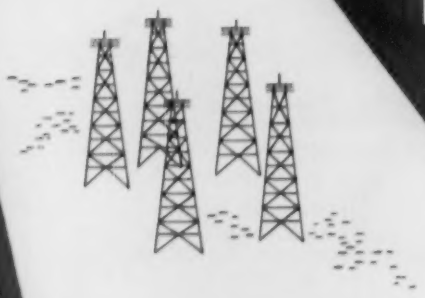
Finest

IN THE FIELD



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- ☐ drying of walls, sheets, etc., after treated with coating material.

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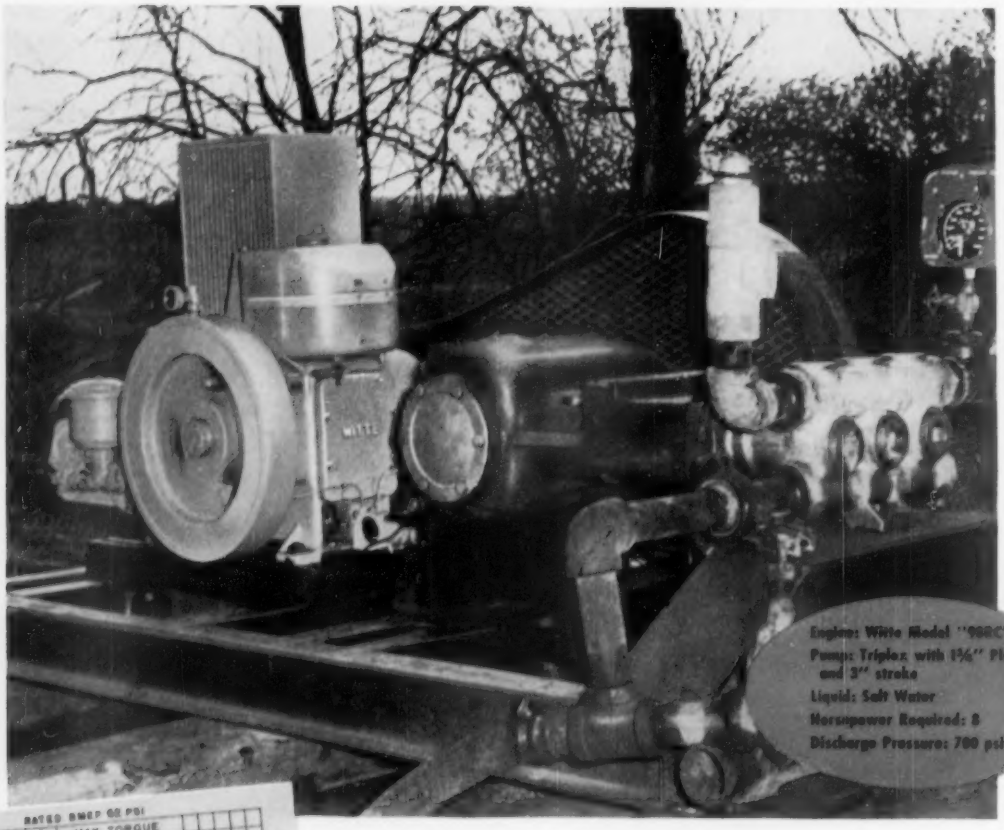
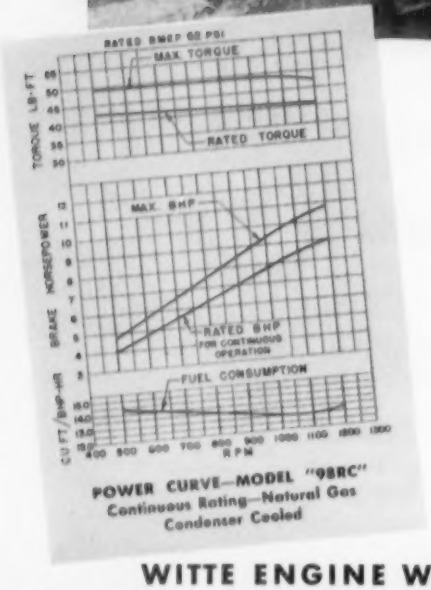

Engine: Witte Model "98RC"
Pump: Triplex with 1¾" Plungers and 3" stroke
Liquid: Salt Water
Horsepower Required: 8
Discharge Pressure: 700 psi



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Continuous Rating—Natural Gas
Condenser Cooled

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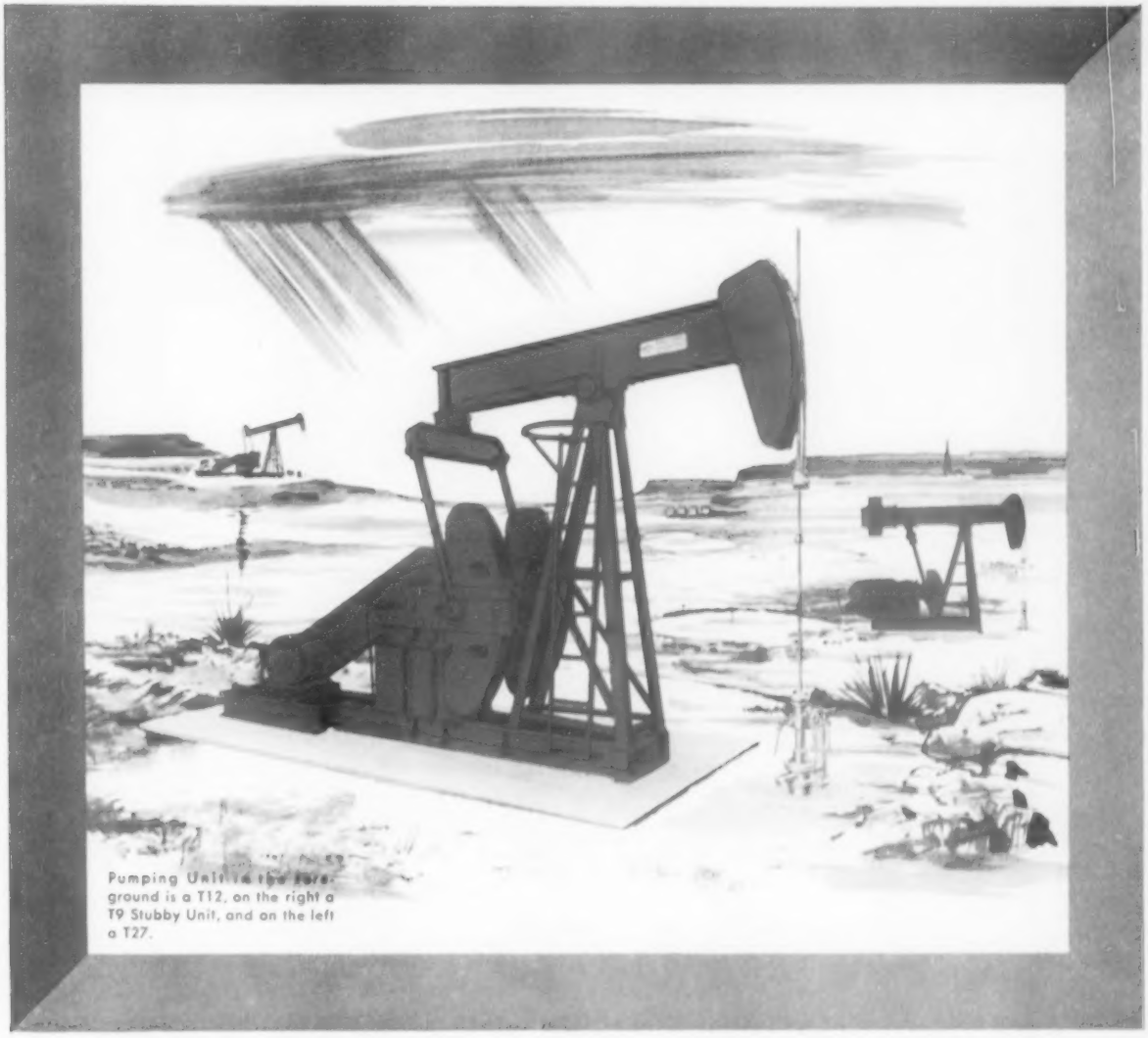

Pumping Units in the foreground is a T12, on the right a T9 Stubby Unit, and on the left a T27.

From the little T3 to the giant T27 American Units reduce pumping costs

Whether the job is large, small, or in-between, there is an American Pumping Unit the right size for your wells. You choose the *exact* combination of structure and reducer needed to pump any well most economically from the complete range of sizes available in American Pumping Units. There are no misfits – no waste – no unused power when you specify AMERICAN.

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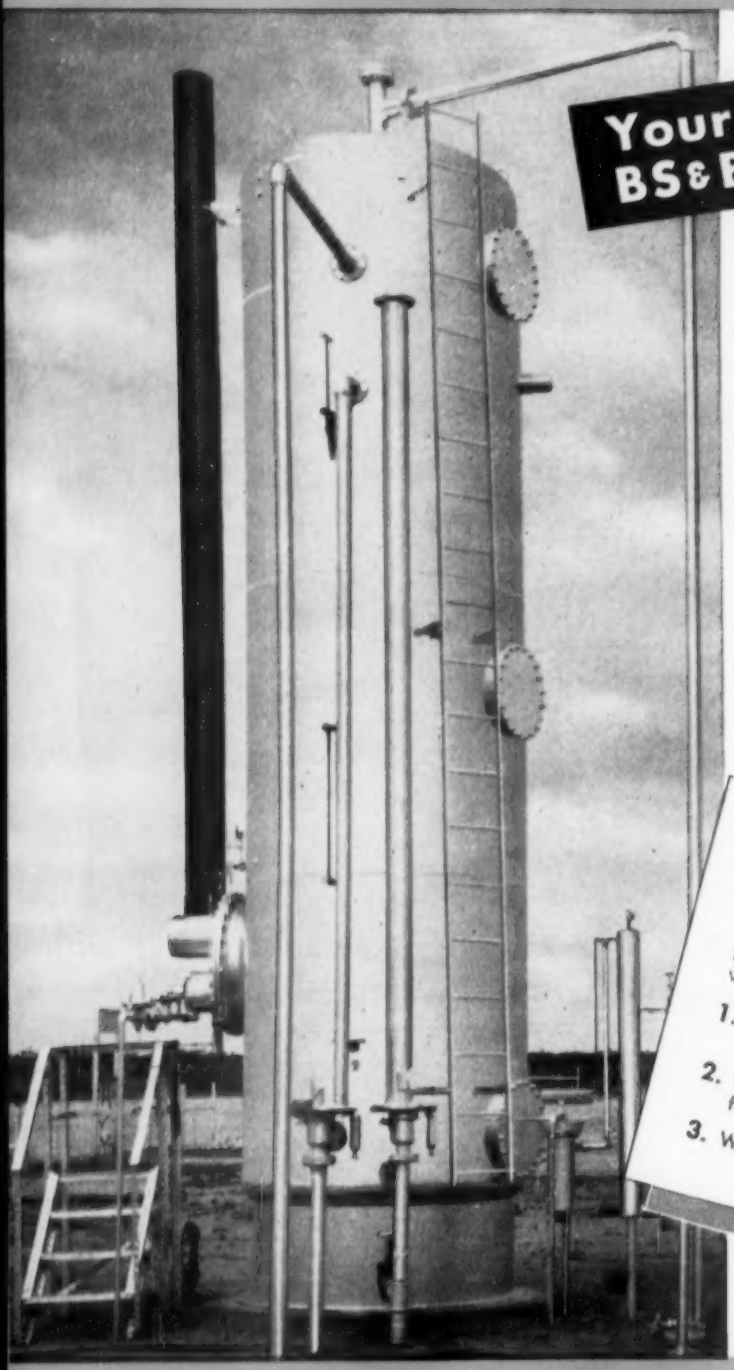

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3. Large Settling Section
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The plastic pipe replaces 2 miles of steel pipe that failed due to salt and sulphur corrosion. A two man crew laid 640 feet of 3 inch rigid vinyl pipe made from Geon resin in an hour. No heavy machinery was used; the pipe is so light a length can be handled by one man.

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Rigid plastic pipe is but one of many products made from Geon polyvinyl materials that show similar economies in both installation and upkeep. Sheets, valves and other products used in the petroleum and chemical industries demonstrate daily the versatile qualities of Geon polyvinyl materials. For information on Geon materials, please write Dept. DT-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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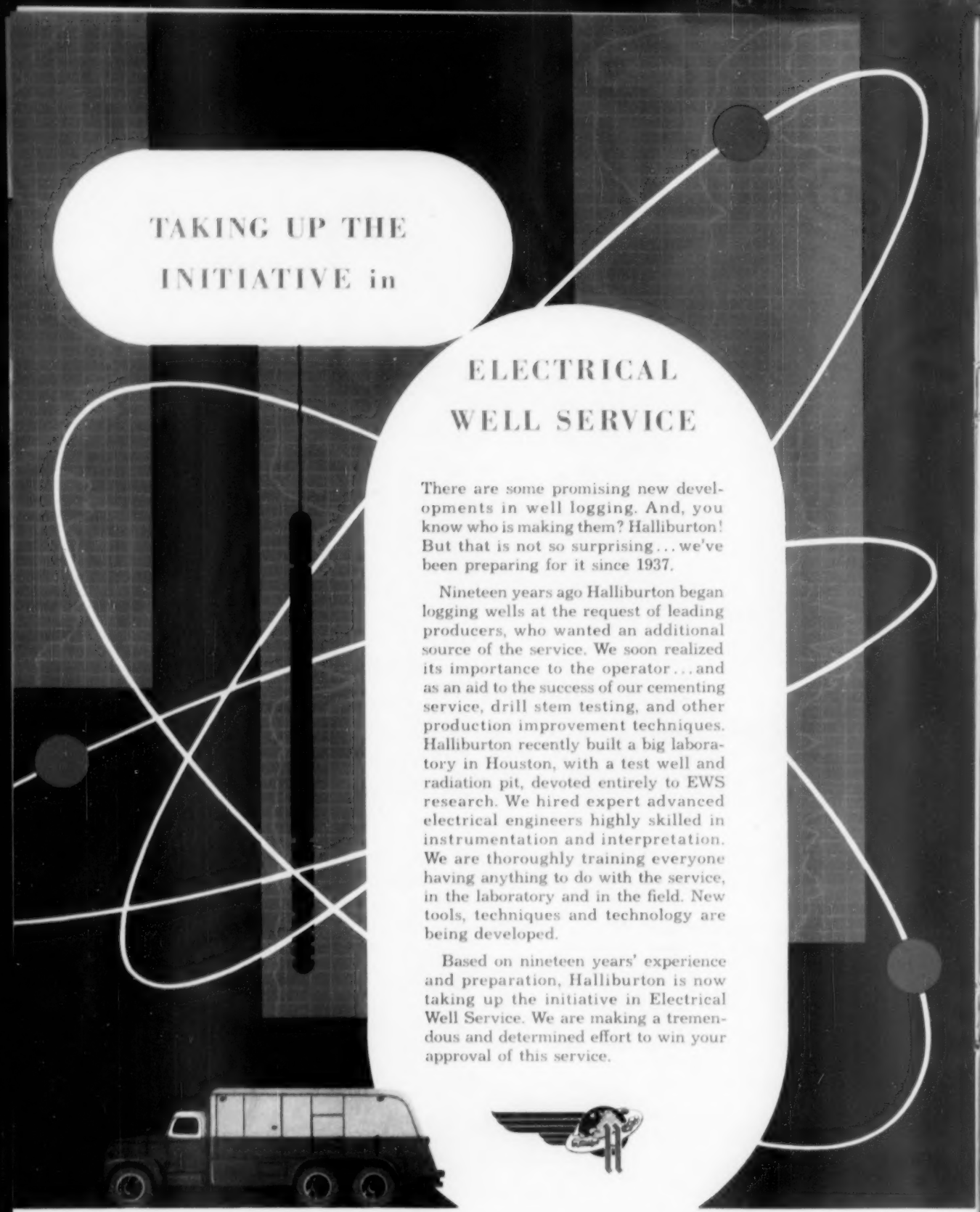
TAKING UP THE
INITIATIVE in
ELECTRICAL
WELL SERVICE
There are some promising new developments in well logging. And, you know who is making them? Halliburton! But that is not so surprising... we've been preparing for it since 1937.
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Based on nineteen years' experience and preparation, Halliburton is now taking up the initiative in Electrical Well Service. We are making a tremendous and determined effort to win your approval of this service.

PROGRESS IN SERVICE THROUGH RESEARCH

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

Log Analysis Like This REDUCES NEED FOR CORING

HALLIBURTON ACCURACY CONFIRMED BY CORE ANALYSIS

RESERVOIR ANALYSIS

DEPTH: 3790-3819
Hoxbar Formation
Rm-1.0 OHM-M AT 110°F

	FROM CORES	FROM LOG
POROSITY	18.2%	17.8%
WATER SATURATION	34%	30%
M.R.H.* (BBLS. PER ACRE FOOT)	650	690

*Maximum Recoverable Hydrocarbons In Place

RESERVOIR ANALYSIS

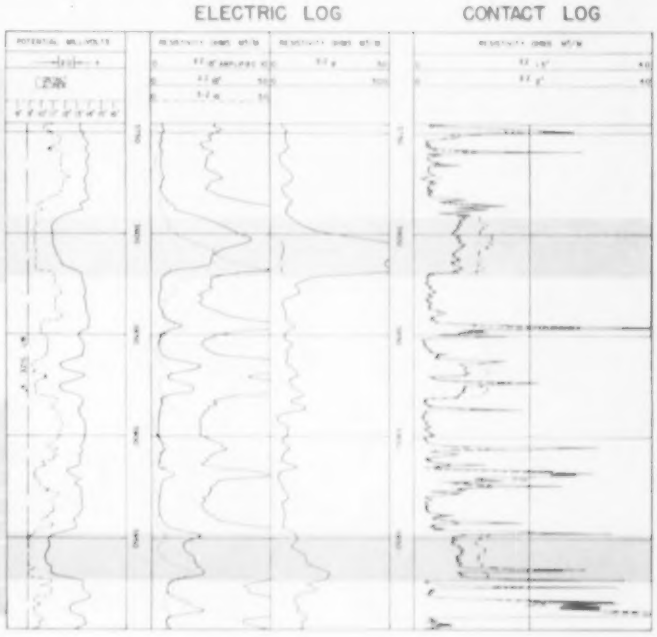
DEPTH: 3947-3969
Hoxbar Formation
Rm-1.0 OHM-M AT 110°F

	FROM CORES	FROM LOG
POROSITY	20.7%	18%
WATER SATURATION	37%	41%
M.R.H.* (BBLS. PER ACRE FOOT)	615	540

*Maximum Recoverable Hydrocarbons In Place

PRODUCTION INTERVAL

PERFORATED
3948-3968
193 BARRELS OIL PER DAY WITH NO WATER



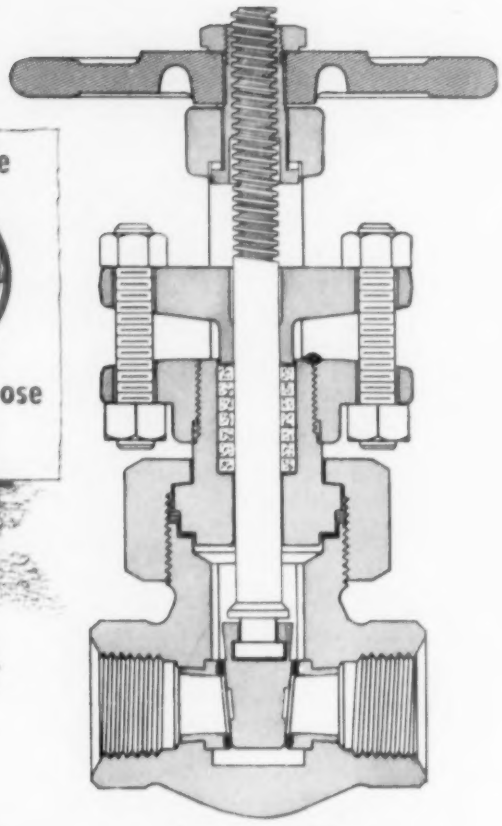
There's no greater proof than shown right here for the accuracy and value of Halliburton's Electrical Well Service when it comes to well and reservoir evaluation. This group of logs from a well in Stephens County, Oklahoma, *one of many examples*, tells the whole story.

Accurate logs such as this and accurate quantitative studies as shown here result from Halliburton taking up the initiative in Electrical Well Services.

COMPLETE DATA SENT ON REQUEST
Add this valuable information to your Halliburton Service File

HALLIBURTON ELECTRICAL WELL SERVICES

250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG



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Oil City, Tex.

Baytown, Tex.

Cutler-Hammer Program Time Switch for scheduling of pumping cycle automatically. Day-omission feature available.

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Get C-H Oil Well Pumping Control that makes it easy to modify restarting characteristics

There is no need to buy replacement starters every time you extend your oil well pumping operations. Cutler-Hammer Oil Well Pumping Control contains provisions that make it a simple matter to change from immediate restarting after a power failure, to manual restarting, or to automatic time-delay staggered restarting. The control panel now readily accepts either a C-H Undervoltage Relay or a C-H Time Delay Relay. Panel space is provided and a diagram inside the cover shows all circuit arrangements with leads numbered to permit easy wiring changes.

Here's how it works. If you are operating just a few wells the basic C-H Pumping Control automatically restarts pump motors just as soon as power is restored. But if you increase the number of wells operating, the combined restarting load of all pumps may become too heavy. Then you add C-H Undervoltage Relay and pumps are restarted manually, one at a time. But if your operations become so extensive as to prohibit manual restarting, you simply change to C-H Time Delay Relay that provides automatic staggered restarting. No need to buy new starters as your needs change. Just the simple, inexpensive addition of one relay or another, in space provided for the change.

This feature is in addition to aluminized enclosure that reflects sun rays and heat; screened and louvered ventilators that shut out dirt and pests; cool, dust-safe vertical contacts; finest program time-switch; full 3-phase overload protection; high torque clock motor; etc., etc., etc. The original oil country pumping control that has no equal. Insist on Cutler-Hammer and refuse all substitutes. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

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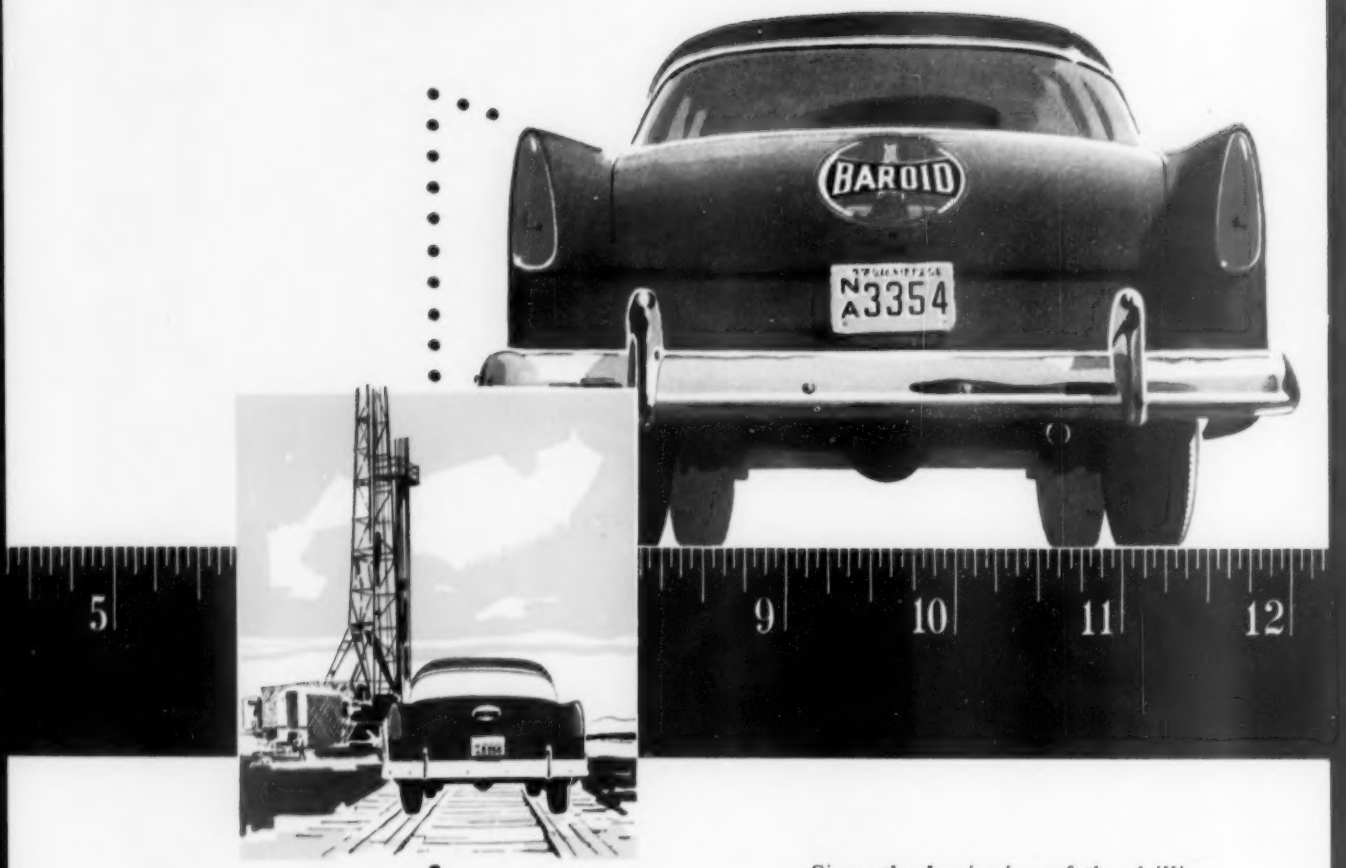
C-H

SERVICE IS THE RULE



Since the beginning of the drilling mud industry Baroid Field Engineering has set the industry service pattern. Baroid established this standard of service before 1930* — Another Baroid "First".

Standardize on Baroid and Baroid Service

* Reprinted from Baroid Weighting Material Handbook published in 1930: "...Our Engineers will be pleased to assist you at any time with any of your drilling fluid problems. For service, information or material, call FAber 0768 at any time of the day or night . . ."

BAROID

BAROID DIVISION • NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

8054

The Ansul dry chemical fire equipment pictured above includes portable hand units, wheeled and stationary units and a jeep installation. Ansul also manufactures automatic dry chemical piped systems, custom engineered for the hazard. Ansul equipment is listed and approved by Underwriters' and Factory Mutual Laboratories.

Only Ansul offers a Five Year Equipment Warranty

Your assurance of fast, dependable fire protection

For you, the buyer of fire equipment, Ansul's important 5 year warranty means many extra years of fast, dependable protection. It also means freedom from costly maintenance checks and repairs.

Special design and construction features make this warranty possible. Ansul's *weather-tight* construction keeps out moisture, resists corrosion. *Patented nozzles* deliver the right kind of stream for your hazard. A *sealed pressure cartridge* puts Ansul's "Plus Fifty" dry chemical to work immediately—no delay or lag. Finally, *rugged construction* makes it possible for Ansul equipment to give peak performance under the toughest operating conditions.

Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Division, Dept. F-93, Marinette, Wisconsin. *Write Ansul for your copy of new Fire Equipment Catalog.*

ANSUL

8034

Enough to run a pipe line from San Francisco to London

THE gas and petroleum transmission industries can take great pride in the gigantic jobs they've completed in recent years.

As a major supplier of large diameter steel line pipe, Kaiser Steel has been privileged to play an important part in these vast undertakings. In five years, enough line pipe of various diameters has been shipped from our Napa, California plant to run a pipe line from San Francisco to London.

Shown below is a partial list of major customers, who have used Kaiser Steel Line Pipe in scattered locations from New York to California, from Canada to Mexico.

CITIES SERVICE GAS CO.
NORTHERN NATURAL GAS COMPANY
PANHANDLE EASTERN PIPE LINE CO.
SINCLAIR PIPE LINE CO.
INTERPROVINCIAL PIPE LINE CO.
OKLAHOMA NATURAL GAS CO.
PLATTE PIPE LINE CO.
NATURAL GAS PRODUCERS, INC.
THE MONTANA POWER COMPANY
COLORADO INTERSTATE GAS CO.
ARAPAHOE PIPE LINE CO.
TRANS MOUNTAIN OIL PIPE LINE CO.
MOUNTAIN FUEL SUPPLY CO.
SOUTHERN UNION GAS CO.
EL PASO NATURAL GAS CO.
PACIFIC GAS & ELECTRIC CO.
STANDARD OIL COMPANY OF CALIFORNIA
UNION OIL COMPANY OF CALIFORNIA
RICHFIELD OIL CORPORATION
SOUTHERN COUNTIES GAS CO.
TIDE WATER ASSOCIATED OIL COMPANY
SOUTHERN CALIFORNIA GAS COMPANY

Kaiser Steel

GULF OIL CORPORATION
GULF REFINING COMPANY
PHILLIPS PETROLEUM CO.
PHILLIPS PIPE LINE CO.
TENNESSEE GAS TRANSMISSION CO.
THE TEXAS PIPE LINE COMPANY
PIONEER NATURAL GAS COMPANY
TRUNKLINE GAS COMPANY
TRANSCONTINENTAL GAS PIPE LINE CORP.
TEXAS EASTERN TRANSMISSION CORP.
UNITED GAS PIPE LINE COMPANY
ASIATIC PETROLEUM CORPORATION
THE PURE OIL COMPANY
SINCLAIR OIL CORPORATION
SHELL PIPE LINE CORPORATION

Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes • semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe • reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

Coin Trick Proves

RO-FLO COMPRESSOR Is Smooth Worker

Smooth Operation is Key to Savings

Everybody around the place knew the *Ro-Flo* compressor was a smooth operator. But just how smooth?

Someone suggested the old coin trick . . . balance a coin on it while it's running.

The next we knew the foreman was calling, "Come down and see for yourself." We went to the shop. And sure enough, there the penny was standing as still as you please.

What does that mean to you?

It means, here's a compressor that needs practically no foundation. And it means there's no wear and tear from vibration . . . less maintenance.

You get constant air supply with this machine, too. For this story: Call your nearby A-C office for complete information, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-4716

Ro-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Ro-Flo compressors provide constant efficiency and air supply for air tools

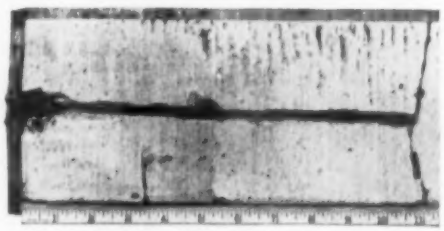
Here's Why . . .

The Welex Swing Jet is the Best Perforator for Permanent-Type Completions

1. **Larger Entrance Hole and Channel** — ½-inch diameter.
2. **Deeper and More Uniform Penetration** — more than 10 inches into the formation.
3. **18-Gram Charge** — the largest of any perforator for permanent type well completions!!
4. **Centralized in Casing** — for four *effective* shots per foot.
5. **Better Breakup and Less Debris** — tiny debris particles easily removed.
6. **Cleaner Perforations** — greater production per unit of perforation.
7. **Quality-Controlled Materials** — Insist on Welex made Swing Jets to insure peak performance.

10¾ INCHES INTO FORMATION

Swing Jet fired *under fluid* into 72-hour aged cement target penetrates ¾-inch steel plate and almost 11 inches of cement. This is the penetration you'll get in your wells regularly with 18-gram Welex Swing Jet charges.

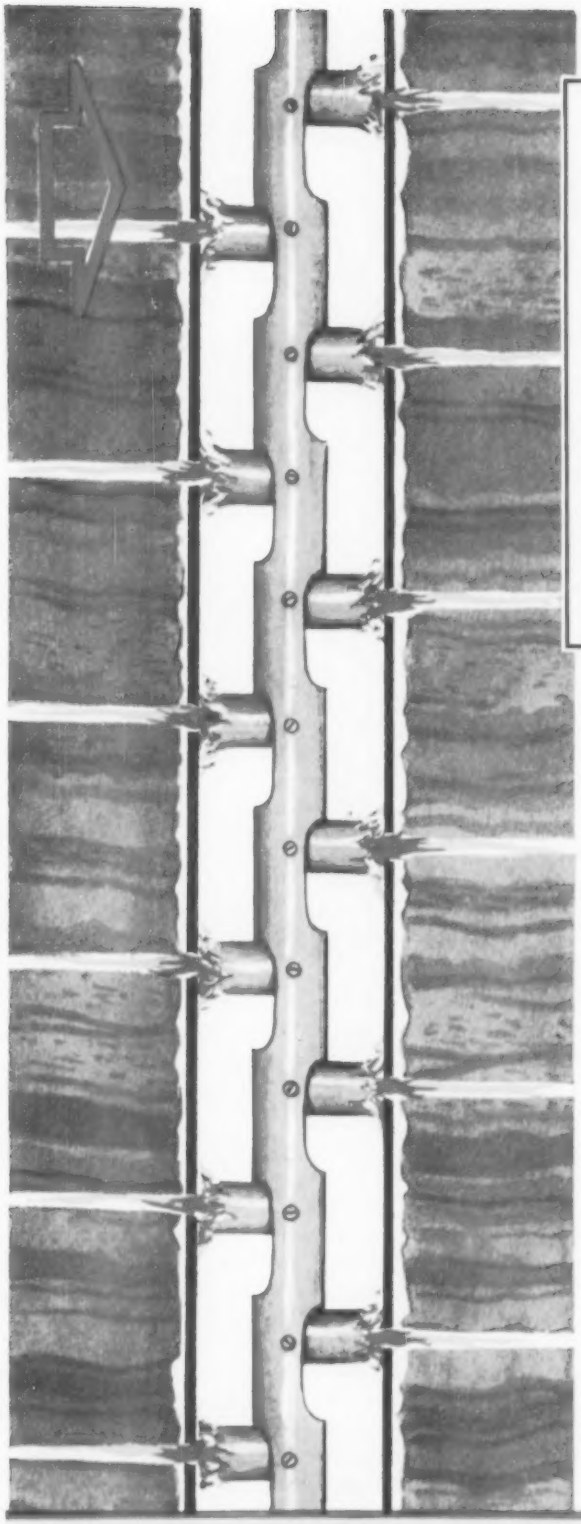


ORIGINATORS OF JET PERFORATING

Welex JET SERVICES, INC.

For Better Swing Jet Service
CALL WELEX AND BE SURE!

GENERAL OFFICES: 1400 East Berry, Fort Worth, Texas
SALES OFFICES: Dallas • Duncan • Lake Charles • Liberty • Wichita
DIVISION OFFICES: Houston • Midland • Tulsa • Oklahoma City • Denver
DISTRICT OFFICES: Abilene • Ardmore • Bartlesville • Beaumont • Corpus Christi
Falfurrias • Farmington • Fort Morgan • Gainesville • Great Bend • Hobbs • Houston
Lafayette • Liberal • Odessa • Pampa • Pauls Valley • Plainville • Pleasanton
San Angelo • Shawnee • Sherman • Snyder • Stillwater • Wichita Falls • Winfield

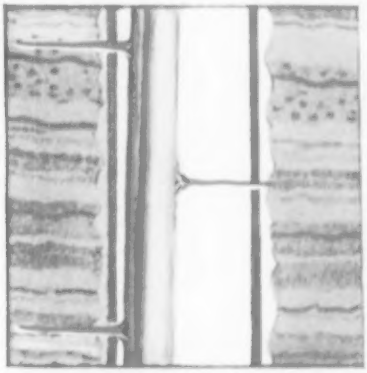


THE WELEX SWING JET IS SAFE IN YOUR WELL

Only the Welex Swing Jet has all the features you need for *maximum* drainage area per shot fired.

Only the Swing Jet has the snap-open carrier that runs full-power, 18-gram charges through the tubing for permanent-type completions. And, only with Swing Jet will you *consistently* get *½-inch* entrance holes and penetrations of more than *10 inches* into the formation.

Don't be satisfied with LESS than full results from every shot! The Welex Swing Jet has now been fired in more than 1200 wells . . . is the preferred jet for permanent-type completions with major and independent oil producers!



How carrier-casing proximity can effect penetration with small charge tubing guns. The Jet must pass through 3 or more inches of fluid before penetrating casing. The Welex Swing Jet is centralized in your casing assuring the optimum distance between charges and casing. Welex furnishes a rigid-type tubing gun and recommends its use only for pipe with an i.d. of 4 inches or less.

ORIGINATORS OF Welex JET PERFORATING

FIRST IN SWING JET DEVELOPMENT AND SERVICE

The Swing Jet was designed and developed by Welex and our field personnel are thoroughly trained to insure peak performance in your well.

strike pay zone faster

with SUPERIOR power!

Superior Diesel or Dual Fuel Drilling Engines are available from 300 to 650 Continuous B.H.P. Superior Gas Drilling Engines from 320 to 630 Continuous B.H.P.

Dependable Superior Diesels practically eliminate costly down-time. With minimum maintenance and repairs, they'll power your rig for many more hours between overhauls, under the most rugged, toughest field service! Hundreds of case histories are firm proof too, that Superior's precision construction cuts fuel and lubrication costs to a bare minimum. Dynamically balanced crankshafts provide practically vibration-free operation at all speeds . . . this enables rapid acceleration for quicker round trips and for fast pipe handling . . . and relieves excess wear on all engine accessories.

Make a Superior investment . . . get all the facts from leading rig manufacturers, or through White Diesel field representatives available in all oil field areas or through the White Diesel Engine Division. You'll see convincing proof Superior Diesels are your best investment! And you can continue to invest with confidence because the vast facilities of the White Motor Company are dedicated to carry on intensified research, development and precision manufacturing of Superior and Atlas Diesel, dual fuel, and gas engines for oil field service.

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • *Plant and General Offices: Springfield, Ohio*

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

PETROLEUM CHEMICALS DIVISION
NEWS

January ★ One of a Series of Interest to the Petroleum Industry ★ 1956

QUESTION BOX

1. WHAT is the *"typical"* American service station operator's reaction to price wars?
(see article at right)
2. WHERE can you look for new program ideas for your next dealer meeting?
(see below)
3. WHOM can you contact for technical service in the Gulf Coast Region?
(see next page)
4. HOW can you prevent *gel-clogged* heating oil lines?
(see next page)

ANOTHER DU PONT MARKETING SERVICE

Wide selection of program aids available for dealer meetings

During recent years, a wide variety of sales promotion aids have been developed by the Du Pont Petroleum Chemicals Division. These are all designed to be readily adaptable by any oil company for use in its own marketing program. And they make ideal program material for dealer meetings.

A new movie, "When the customer says 'KNOCK,'" is one example of the material available. This explains the common causes of knock other than gasoline quality and helps your dealers answer customer complaints in a salesmanlike way. You can follow up this film with a series of cartoon booklets that will help the dealers remember its message.

Another unique film presentation showing dealers how they can easily *sell themselves* is narrated by an animated cash register. And there are flannelboard presentations on gasoline and lubricating oil quality. Chassis dynamometer and single-cylinder engine demonstrations are also included. For special programs, you can even arrange to use the Du Pont fleet of fuel test cars.

For more information on these and other dealer meeting aids, just get in touch with any of our sales offices. Ask for a copy of "Sales Promotional Aids for Dealer Meetings."

WHO is your "typical" dealer... and HOW does he operate?

Many important facts about the man and his business are revealed in Report No. 4 of Du Pont's continuing market survey, "The Service Station Operator"

Thousands of customers form, confirm, or change their opinions of your company every day . . . based on the impressions made by your service station operators. Because of this, a composite, cross-section picture of the average dealer can be valuable to you in formulating dealer policies and sales promotion plans.

"The Service Station Operator" is a new Du Pont survey designed to give you a clear, concise picture of the average American dealer . . . his employees, his business, his opinions, his background, his relation to his petroleum products supplier, and his motivations. Three reports on this survey have already been published and made available to marketers by the Du Pont Petroleum Chemicals Division.

They cover (1) such dealer retail functions as station hours, gallonage, credit and mailing lists; (2) dealer knowledge of products, additives, sales assets, and prices; and (3) opinions on dealer meetings, advertising, dealer publications, and sales aids.

Report No. 4

The fourth report in the series, which has just recently come off the press, discusses the dealer's relationship with employees, his income and reactions to price wars, and his interests in dealer association activities.

The statistics included in the report are graphically illustrated with charts and are enlivened by cartoon drawings. This format makes the important points easy to reach, remember, and refer to.

What happens when . . .

For example, how does the average dealer react to a price war in his own marketing area? That is one of the factors influencing your business which is covered in Report No. 4.

Most of the dealers who have experienced price wars, the survey found, encountered them within the past year. What did they do? . . . The biggest percentage of them met the competition by cutting their own prices. A number of them, however, decided to hold out and refused to cut their prices. Other interesting reactions are also tabulated in this survey report.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *"Dealer Survey"*

What's next?

A fifth report on "The Service Station Operator" survey is due to be published soon. This will be the most significant of the whole series of reports. It will discuss the interrelationships of all the factors covered in previous reports . . . such as how dealer meetings, station hours, price wars, and other variables affect sales volume.

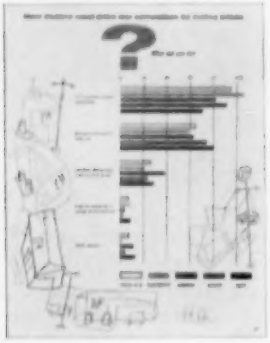
As part of the continuing market research work of the Du Pont Petroleum Chemicals Division, this dealer survey is the natural follow-up of an earlier survey on the buying habits of consumers at service stations. The interviews were conducted on a completely impartial basis by National Analysts, Inc.

Specialized cross-tabulations

Based on personal interviews with 2,633 service station operators – selected by the scientifically accurate area-sampling method – the survey is representative of all the operators in the United States. But the results can be broken down and cross-tabulated to give a true sample of any of four geographical areas.

And in addition to the regular distribution of reports to marketing executives, the entire survey has been tabulated on IBM cards, which will give a wide variety of specialized breakdowns to meet the individual needs of various oil companies.

For more information about this survey, just get in touch with any of our sales offices listed below.



HERE IS a typical page from Report No. 4 on "The Service Station Operator."

GULF COAST REGIONAL LAB MANAGER

John N. C. Cameron, manager of the Du Pont Petroleum Chemicals Division's regional laboratory in Houston, Texas, is in charge of customer service, product testing and additives treating recommendations for Du Pont customers in the Gulf Coast Region.

Before joining the Du Pont Company in 1949, Mr. Cameron was with the Research and Development Division of Humble Oil and Refining Company at Baytown, Texas. During his seven years with this company he worked as a research chemist on octane rating and light oil analytical research. He also did pilot scale research on catalytic treating. Prior to his assignment at Humble, he was employed for three years by the Gravity Meter Exploration Company in Houston.

After starting his college career at the University of Texas, he transferred to the University of Houston, where he received his B.S. degree in chemistry.

Mr. Cameron is a member of the American Chemical Society.

Gel-Clogged Heating Fuel Line!

. . . you can avoid this complaint

A rash of clogged fuel line complaints can quickly jockey you into some rather embarrassing situations. On the other hand, you can easily avoid this kind of trouble before it starts.

If the fuel oil is at fault, the clogging generally occurs in the line leading from the fuel oil storage tank to the burner, or at the screen ahead of the fuel pump. This clogging is generally due to the formation of a *gelatinous* material. And copper or brass are the culprits.

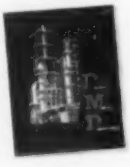
Since the feed-in line and the screen are often made of copper alloys, these are a potential source of copper mercaptides. If formed in sufficient quantities, the mercaptides become gelatinous in nature. So to prevent the clogging you must protect your fuel against the harmful effects of copper.

Here's how . . .

You can help assure adequate protection with DMD (Du Pont Metal Deactivator). It is highly effective in most fuel oil stocks in low concentrations (about 2 pounds per 1000 barrels).

This means that you can, in most cases, insure yourself against the harmful effects of copper–and promote better customer relations, too–at a cost of *less than ½ cent per barrel.*

For best results, it is recommended that you use DMD in combination with Du Pont Fuel Oil Additive No. 2 which guards against sludge.



THIS BOOKLET describes the properties, uses, and methods of addition of DMD. If you do not have a copy, any of our sales offices listed below will be glad to send you one.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

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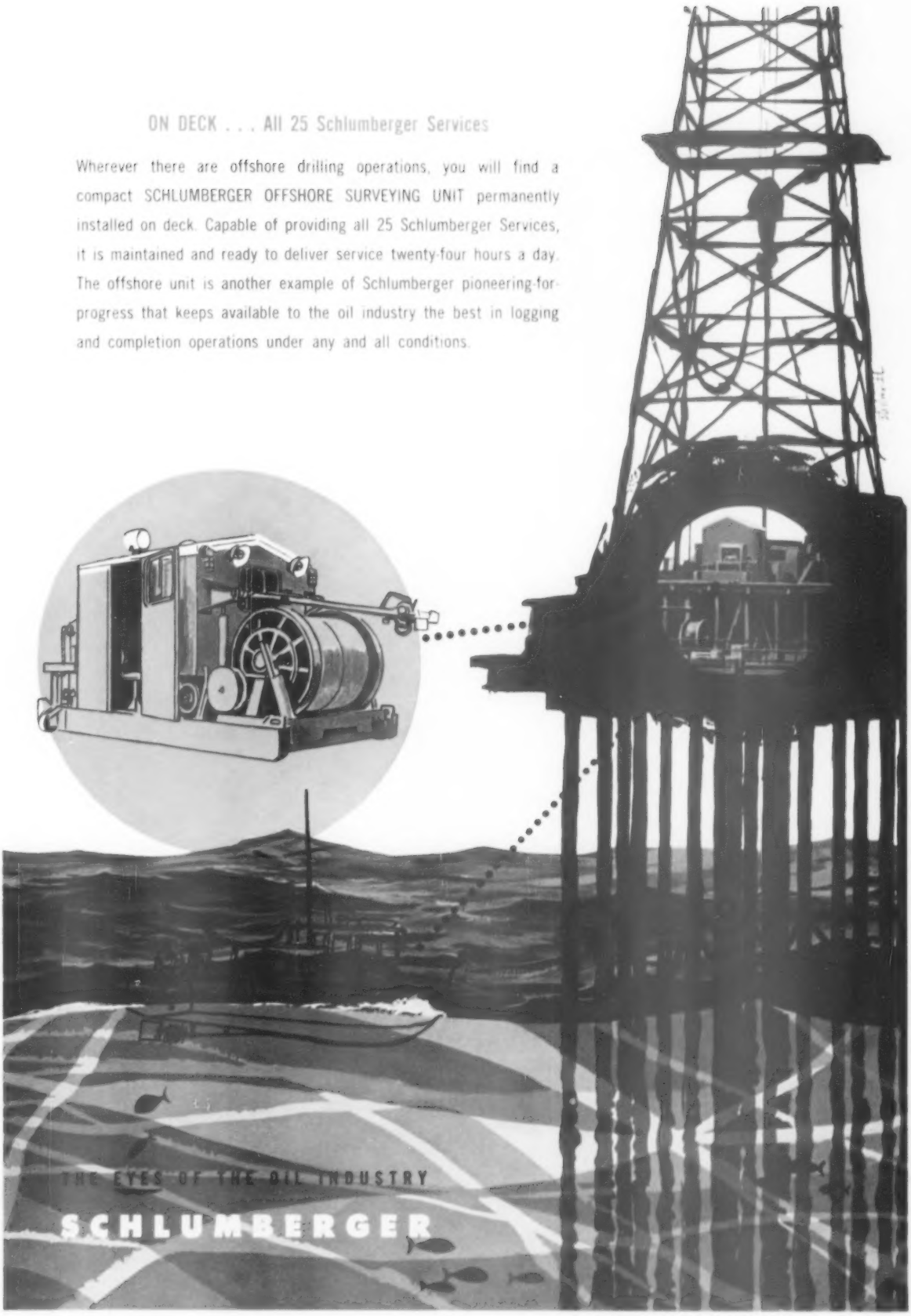
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

Printed in U. S. A.

ON DECK . . . All 25 Schlumberger Services

Wherever there are offshore drilling operations, you will find a compact SCHLUMBERGER OFFSHORE SURVEYING UNIT permanently installed on deck. Capable of providing all 25 Schlumberger Services, it is maintained and ready to deliver service twenty-four hours a day. The offshore unit is another example of Schlumberger pioneering-for-progress that keeps available to the oil industry the best in logging and completion operations under any and all conditions.



The PEOPLE....

. . . who support the SERVICE TEAM

The TEIA Salesman-Serviceman, the Underwriter, the Safety Engineer, the Claim Man, the Payroll Auditor . . . these are the members of the TEIA SERVICE TEAM directly providing you with the best possible Workmen's Compensation Insurance SERVICE.

But, supporting this SERVICE TEAM are hundreds of Home Office and District Office workers . . . the important "behind-the-scenes" people who are trained to render specialized Workmen's Compensation services. They, too, are constantly striving to provide you with better service and help you SAVE money.

MILLIONS OF DOLLARS
Saved and Returned to
POLICYHOLDERS *by*
TEXAS' *Largest Writer of*
WORKMEN'S COMPENSATION

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*

Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO
FORT WORTH • FREEPORT • GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND
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TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE · DALLAS, TEXAS

the spudder that leads

THREE LIVES

One reason why more Bucyrus-Erie spudders are in use today than any other make is their ability to make money on a wide range of jobs. They handle top-to-bottom drilling, well completion, and workover operations equally well and have the mobility to get around from job-to-job in a hurry.

FOR DRILLING top-to-bottom, they combine big capacity, ample power, and hard-hitting spudding motion to produce hole fast. Four models to suit your requirements: 48-L swings 6,000 lbs. tools, drills to 6,000 ft.; 36-L handles 4,200 lbs. tools, drills to 3,500 ft.; 28-L tool rating 3,000 lbs., depth 2,500 ft.; 60-L swings 2,750 lbs. tools, drills to 1,500 ft.

FOR DRILLING IN, Bucyrus-Erie spudders start working within a few hours after rotaries are moved off. Mobile single- and tandem-axle mountings (or easy moving skid-type base) cut a big slice off downtime and add it to working time. Setting up is quick and easy, too.

FOR SERVICING JOBS, three-drum arrangement with fast, powerful line pulls simplifies handling of tools, bailer, casing, tubing and rods. Two forward speeds and one reverse on all drums and catheads (except 60-L which has one speed forward and reverse) provide split-second control. 17555

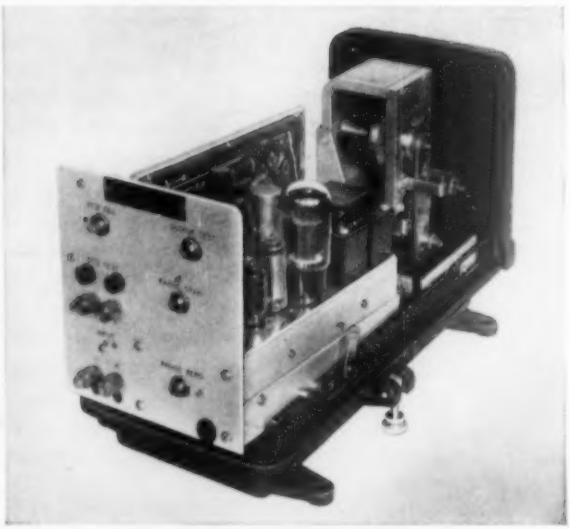
Put a Bucyrus-Erie spudder to work for you for reliable, versatile, profitable performance. Get detailed information from your Bucyrus-Erie spudder distributor.

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN

Now! A TAYLOR

Plugging in the Transducer. This exclusive plug-in feature applies to both the transducer and the amplifier. Means quick, easy removal for service; minimum instrument down-time; checking can be done in the shop where full facilities are available. Also permits separate calibration.



Plugging in the Amplifier. See how easily units are locked into the chassis. Also note screwdriver adjustment of range span and zero suppression by virtue of unique potential dividers. Exclusive Taylor vernier adjustment permits resolution of 1 part in 100,000.

POTENTIOMETER TRANSMITTER

with all the innovations, ruggedness, dependability and versatility that industry expects from Taylor

TAYLOR has broadened its base of measurement with the introduction of an electronic instrument that extends the versatility of its pneumatic controllers and receivers. The TRANSET* Potentiometer Transmitter is a completely adaptable instrument for the measurement of a wide variety of variables, and can be quickly modified for use with different electrical primary elements. This ingenious instrument reflects Taylor's years of experience and knowledge of the requirements of the processing industries.

The TRANSET Potentiometer is especially adaptable where processing conditions require pneumatic controllers and receivers, and where conventional measuring circuits have not proved adequate. In thermocouple applications, for example, it can accurately measure temperatures within limits of minus 320°F. to plus 3272°F., with range spans as short as 100°F., depending upon the characteristics of the thermocouple used.

*Reg. U.S. Pat. Off.

Plugging in the Input Circuit Board. It can be quickly adapted for use with different primary elements by simply plugging in the corresponding input circuit; e.g., for thermocouple applications cold junction compensation is provided in the plug-in circuit board. One instrument can therefore be used as a spare wherever a transmitting potentiometer is used.

Why experienced instrument men say— "most practical instrument of its kind"

1. The unit is automatically, continuously standardized and offers complete electronic balance, permitting optimum response adjustments. There are no slide wires or motor drive.

2. High Input impedance. No need to match resistance of leads.

3. Output impedance is virtually infinite. Its 0 - 5 milliamp signal can perform multiple auxiliary functions without affecting accuracy of pneumatic signal.

4. Range span and zero suppression adjustments are easily made by screwdriver due to unique design of high resolution potential dividers.

5. Both electronic and pneumatic units plug-in. Simplifies service; permits separate calibration.

6. Normal load is automatically inserted when amplifier is removed for service.

7. Modern printed circuits insure uniform performance. Test terminals provided for trouble shooting.

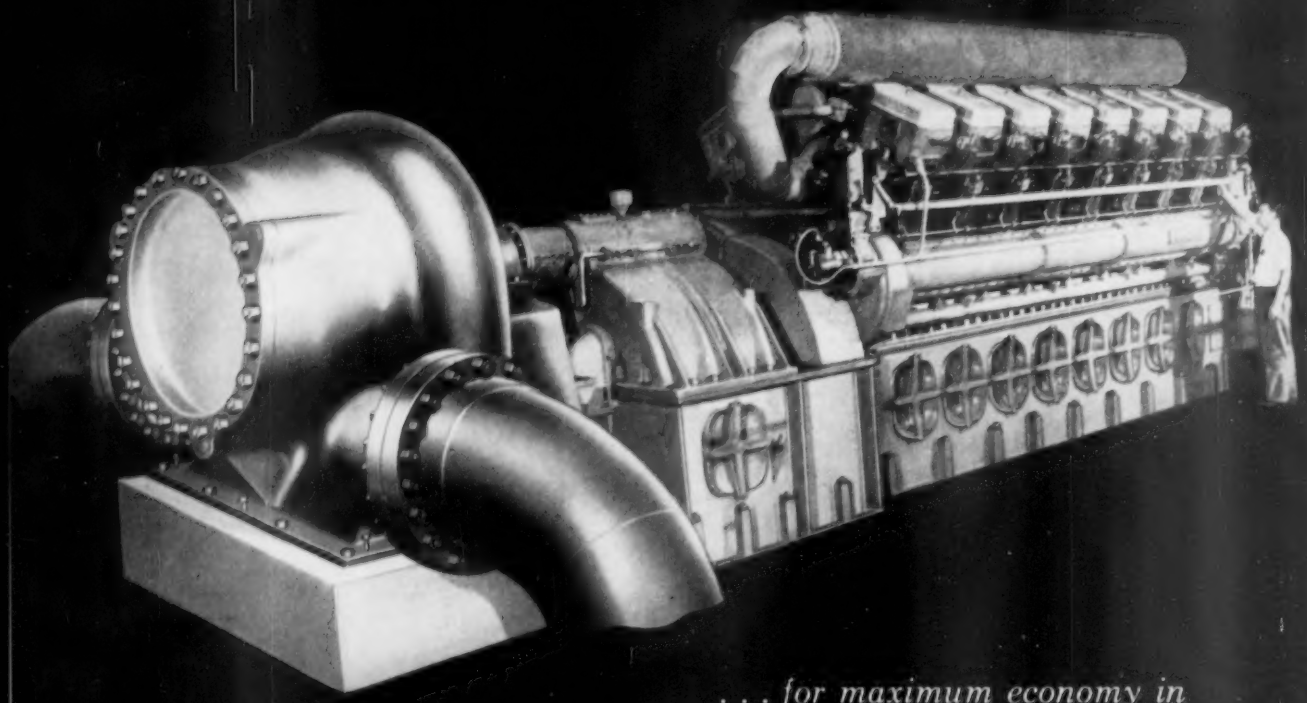
8. Three-circuit jack on front panel permits easy monitoring of output current. Convenient pin jacks provided for checking standardization voltage.

9. Three-piece, purged cast-aluminum case is moisture and corrosion proof. All adjustments are readily accessible.

10. If used only for scanning, logging or similar auxiliary functions the instrument is available without transducer.

Write for Bulletin *98262. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



. . . for maximum economy in Gas Pipe Line service . . .

THE NORDBERG *SUPAIRTHERMAL*®

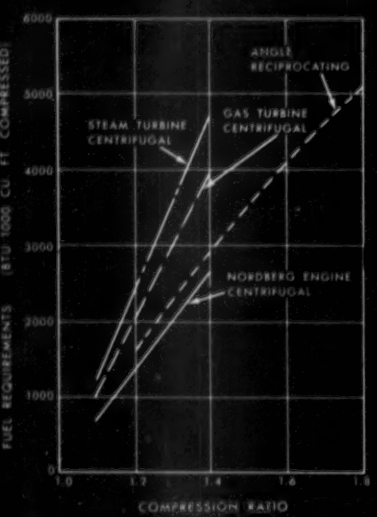
ENGINE-DRIVEN CENTRIFUGAL COMPRESSOR UNIT

Here is the latest development in compact, dependable power for maximum efficiency and economy in gas pipe line transmission service . . . *The Nordberg Supairthermal Engine-Driven Centrifugal Compressor Unit.*

Through use of exclusive design principles, the Nordberg *Supairthermal* spark-ignition gas engine operates at better than 40% thermal efficiency — with correspondingly lower fuel cost, increased horsepower, lower lube oil consumption, and lower maintenance costs per horsepower hour. The *Supairthermal* engine drives the compressor through a close-coupled speed increasing gear mounted on the bedplate extension of the engine.

Here, then, is an extremely compact, efficient engine-driven compressor unit which can be installed at low capital investment and operated at lower cost per horsepower than any other type of gas pipe line prime mover.

NORDBERG MFG. CO., Milwaukee, Wisconsin



Savings of thousands of dollars per day in fuel costs on large gas pipe lines can be realized with the Nordberg engine-driven centrifugal gas compressor unit because this unit requires less fuel to compress gas than any other modern type of equipment of comparable capacity.

NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

© 1955, Nordberg Mfg. Co. 0155

FOR MORE INFORMATION AT THE BOTTOM OF YOUR WELL

Double Shut-In Pressure Readings Provide More Information — In Less Time — Than Other Methods

"WHAT IS THE main advantage of double shut-in pressure readings?" That's a question often asked by those who have not yet tried this newest method of drill stem testing.

Actually there are *four* main advantages of the double shut-in pressure method:

1. Maximum formation pressure build-up in shortest time.
2. Comparison of reservoir build-up pressures before and after test.
3. Two separate chances to obtain reservoir pressure.
4. The measuring of the true equilibrium pressure prior to producing the formation provides a virgin pressure measurement and more accurate data.

Perfected by Johnston Testers, this new technique requires only a simple rearrangement of the test tool assembly. By placing a disc valve above the main or hydraulic valve, a specified volume of air is trapped between these two valves. This volume of air is called the "air chamber."

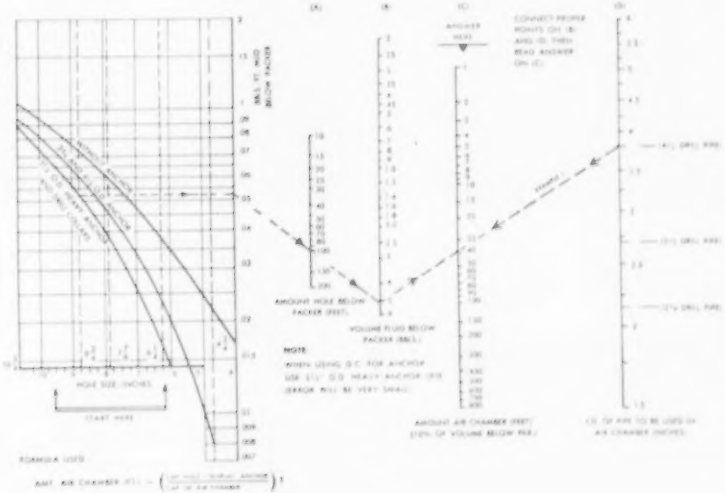
As the purpose of the air chamber is to relieve the mud pressure trapped below the packer, the secret of success of double shut-in testing is accurate use of this air chamber. Best results have been obtained when volume of the air chamber is about 10% of the volume of mud below the packer.

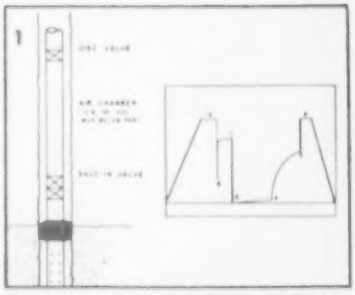
In the past, it has been common to calculate the air chamber to the nearest 30-foot pipe length. This lack of accuracy has often caused a failure to record the *maximum* initial shut-in pressure.

To overcome this problem, and to do away with complicated mathematics, Johnston has developed an "air chamber alignment chart." By simply drawing straight lines between known figures, the amount of air chamber needed can be calculated quickly and accurately.

The chart below shows how simple it actually is to use this method.

Complete information on double shut-in testing is available from Johnston Testers, Houston, Texas. Write today for complete descriptive folder.





Testing tool assembly for double shut-in pressure readings which permits a limited fluid withdrawal. By placing the disc valve above the main or hydraulic valve so that a specified volume of air is trapped between these two valves.

Well not capable of producing fluid fast enough to fill up air chamber and cause pressure build-up.

Mud did not expand enough to get pressure draw-down below the formation pressure.

Mud expanded and pressure draw-down was below the formation pressure. Well was able to flow enough fluid to fill up air chamber and build-up shut-in pressure.

JOHNSTON TESTERS

first in drill stem testing

HOUSTON, TEXAS

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D5551

FORMATION AND CASING TESTING — JOHNSTON

"Take a look at this Pritchard tower framework, Paul!"

"I'm looking. What's so special?"

"Well—one thing—they've cut out a lot of excess framework."

"Is that good?"

"I'll say it is! By cutting out a lot of the excess framework, they have made the tower much stronger. You see, Paul, they make each diagonal member carry the load both in tension and compression. And these Pritchard connector castings take the stress and strain off the bolts. See! Less material—more strength."

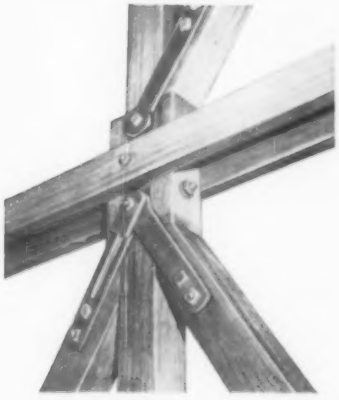
"With less material, I'll bet the tower goes up faster."

"Right. Another thing I want you to look at. Take a look down there—at the basin. That's a new Pritchard design, too. They have anchoring only around the periphery of the tower. Inside, you don't have to build post-supporting piers. Pritchard furnishes post extensions to the bottom of the basin. That saves time and money."

"Sounds so simple. Why didn't we think of Pritchard before?"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.

"Take a look at this Pritchard tower framework, Paul!"



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Pritchard industrial cooling towers meet or exceed new CTI standards!

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REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

They Say—

Future Canadian Markets

"Whether Canadian crudes can compete with imported crudes for the Montreal refinery market remains to be seen. Under present conditions of international trade in crude oil it appears unlikely.

"This need not distress us. It is in fact very much to our interest that the greatest possible freedom of trade in oil should exist. The best return to our producers of oil will result if, after serving the economically available Canadian market areas, they have free access to the export markets in which they can compete. These markets of course lie primarily in the oil-deficient areas of the Pacific Northwestern and Central Northern United States.

"We have recently had some reason to doubt whether these export markets would continue to be available to us. We have had to contemplate the slowing down of production, and the development of new high cost domestic markets, which might have been forced upon us had these markets just across our borders been closed to us.

"I am sure you have all welcomed, as have we in Ottawa, the recent decision by the responsible U. S. authorities not to restrict imports of Canadian crude oil into the United States. So long as that policy continues, we can look forward to orderly and economical development of markets for our crude oil on a straightforward competitive basis. We ask no more, nor do we have any reason to expect less."

C. D. Howe, Canadian minister of trade and commerce, in address in Calgary before Canadian Institute of Mining and Metallurgy.

Money Changes Hands

"Here is the important thing about income change since 1900. The lower and middle income groups have received the greatest share of our increased income.

"Early in the century, only 1 out of every 10 American families earned as much as $4,000 a year in terms of today's prices. Now almost half of our families earn more than $4,000 a year.

"Those with inadequate incomes for a decent living are becoming fewer and fewer, and more and more of them are becoming 'haves'—people who have enough money not only to live adequately, but to save besides. That is the basic economic development in this country which we are trying most fer-

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Whether your pipe is protected as it leaves the tube mills, en route to destination or at a plant in your operating area, you'll be money ahead to give your steel pipe the lasting protection assured by PLS mill-applied cleaning, priming, coating and wrapping.

It's the extras you get through PLS service that make the difference in the quality and durability of the protection applied.

Every operation is *under-roof*, handled only by experienced personnel using the most modern, PLS-designed equipment. You get the benefit of drying ovens. Shot-cleaning. Electrical inspection. Ample storage facilities. In-transit privileges. On-time delivery.

It all adds up to sound economy, reflected by extra years of dependable corrosion protection.

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vently to keep going, and to continually improve."

George M. Humphrey, U. S. Secretary of the Treasury, in address before 35th annual session American Petroleum Institute, San Francisco.

How to Keep Young

". . . For people, 65 has become the accepted retirement age, but . . . at 65 Union Oil is no closer to retirement than it was the day it was born.

"In our business a company doesn't endure if it allows itself to grow old—old in ideas, old and satisfied with things the way they are, old in the sense that it loses its competitive drive.

"Because competition keeps a company young . . . or eliminates it from the race."

Roy Linden, vice president and sales manager, Union Oil Co. of California, in "the Minute Man," company publication which commemorated Union's 65th birthday.

Unitize in California

"If oil, long a cornerstone in Kern County's economy, is to continue to play a vital role in that economy, it must be conserved.

"And if efficient practices can be instituted on a wide scale through 'unit operation' methods, ultimate total oil production in the county can be approximately doubled.

"A majority-rule unitization law in the state is needed to enable producers to put unit operation methods into effect extensively."

Charles S. Jones, president, Richfield Oil Corp., in address before Bakersfield, Calif., Rotary Club.

Irish Luck in Canada

Dear Sir:

Through one of your subscribers, Paul McKay of Fort Wayne, Ind., I received a copy of The Oil and Gas Journal for November 21. On page 101, I read of the controversy between Canadians and the Pennsylvanians as to which one first "struck oil." Perhaps what I have to say may be of interest to you. So here goes.

My grandfather, James Callinan, born in Ireland, was sent by Her Magesty, Queen Victoria, on a mission of some sort to Canada in the early 1850's. He settled near Petrolea, Ont.

One day, he and his friend, Tobin, were strolling around and all at once grandfather noticed a translucent film on water puddles in the road. With the Irishman's insatiable curosity and impulsiveness, he investigated, bought land, and began prospecting. So did Tobin; but not a drop could he squeeze out of his side of the road. Grand-

Power to get more oil . . .

It takes controlled power to get top results from fracturing—like the power of this Dowell twin Continental unit. Dowell's skilled engineers use job-engineered equipment, plus high-quality materials, addition agents and acids to boost production daily in every major field. Call Dowell for Sandfrac®, Petrofrac®, Acid Petrofrac, Petrojel and other exclusive Dowell fracturing services tailored to your well.

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The facts behind the Success of the

MARTIN CAGE

When pencil, paper and manufacturing skill were fused in the development of the Martin Cage, one guiding thought was held constantly in mind. *Make a better cage — a cage which would stand the terrific punishment that caused ordinary cages to fail.*

The result, of course, was the Martin Cage. And today, after years of use by economy-minded producers, this one significant fact remains undisputable. *With Martin Cages, ball and seat life is often doubled . . .* So successful has been the Martin Cage that some manufacturers are attempting to follow in its footsteps. Naturally, only Martin can make a Martin Cage.

The secret of Martin Cage's long life is the oil proof rubber ball guides. The resilience, resistance to sand abrasion, non-magnetic character and electrical resistance of this rubber guide successfully combat cage problems. They are manufactured in

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open and closed types . . . all diameters and styles. Write for the new John Martin Catalog No. 4, with helpful information on how to select the correct cage for your particular installation.

Martin Cages are available through all supply stores.

JOHN N. MARTIN
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father, however, opened up a gusher. What he did was to unearth a shallow field and the thick black liquid mass spouted up in a steady stream. He and his three sons, Thomas, Richard, and Michael, my father, sunk wells, some good, others duds, and pumped oil for over 50 years. So, having been born and raised with oil, I, at my age of 77 years, know something about the industry.

We claim Canada pre-dated Pennsylvania; probably it was the same vein which ran down and was opened up by Drake near Titusville.

It is interesting to know that in the early years of this country a group of young men met in the back room of a tavern in Petrolea and planned a course of action, the purpose of which was to make Canada an oil country. They asked the older men of the town to join with them but they refused because they had no confidence in the "youngsters" as they called them. Among their number was Alec McQueen. From this little beginning grew the Imperial Oil Co. of Canada, and Mr. McQueen became either one of the presidents or vice presidents, I've forgotten which.

Sara Callinan Cummings
Philadelphia, Pa.

Editor's Note: Bless the Irish, and the Callinans — James, and his sons Thomas, Richard, and Michael, and also 77-year young granddaughter Sara, for this very interesting account of their discovery of oil near Petrolea, Ontario, in the early 1850's.

Canadians Penalized

"I do not agree . . . that it has been a lack of faith for Canadians' relatively small participation in their country's oil development. Rather it is the tax provisions which are in their law. Strangely enough, it is the Canadian company and the Canadian individual who are denied the opportunity to compete on equal terms with their U. S. counterparts.

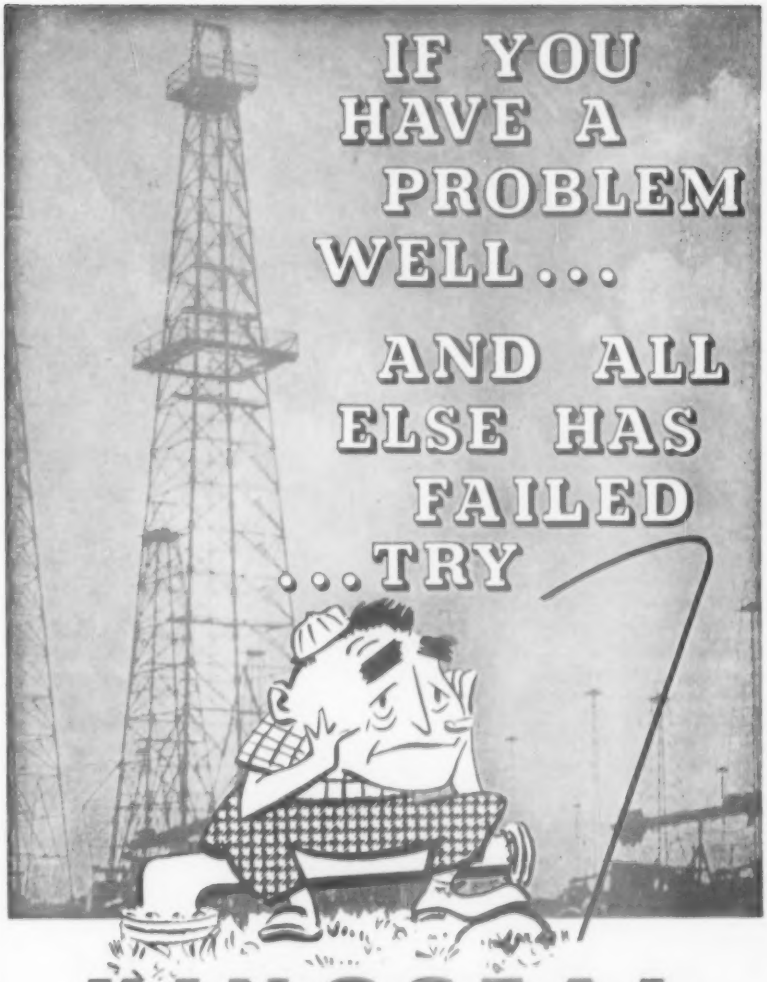
"With this unequal competition, it was only natural that vast sums of U. S. money came to Canada . . ."

Glenn E. Nielson, president of Husky Oil & Refining, Ltd., in appearance before royal commission at Calgary on Canada's economic prospects.

New Records for Gas

"The gas industry established new records in 1954 and is on its way to break those records in 1955. On the basis of figures to date, total sales of gas are running more than 8 per cent ahead of last year and may reach a new high of 66 billion therms.

"We continue to add more than 800,000 new customers a year and



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The answer to troublesome wells when lost circulation is the major problem. If you have a problem well . . . and nothing else will do the job, Kingseal and Queenseal will. Write, wire or phone collect . . .

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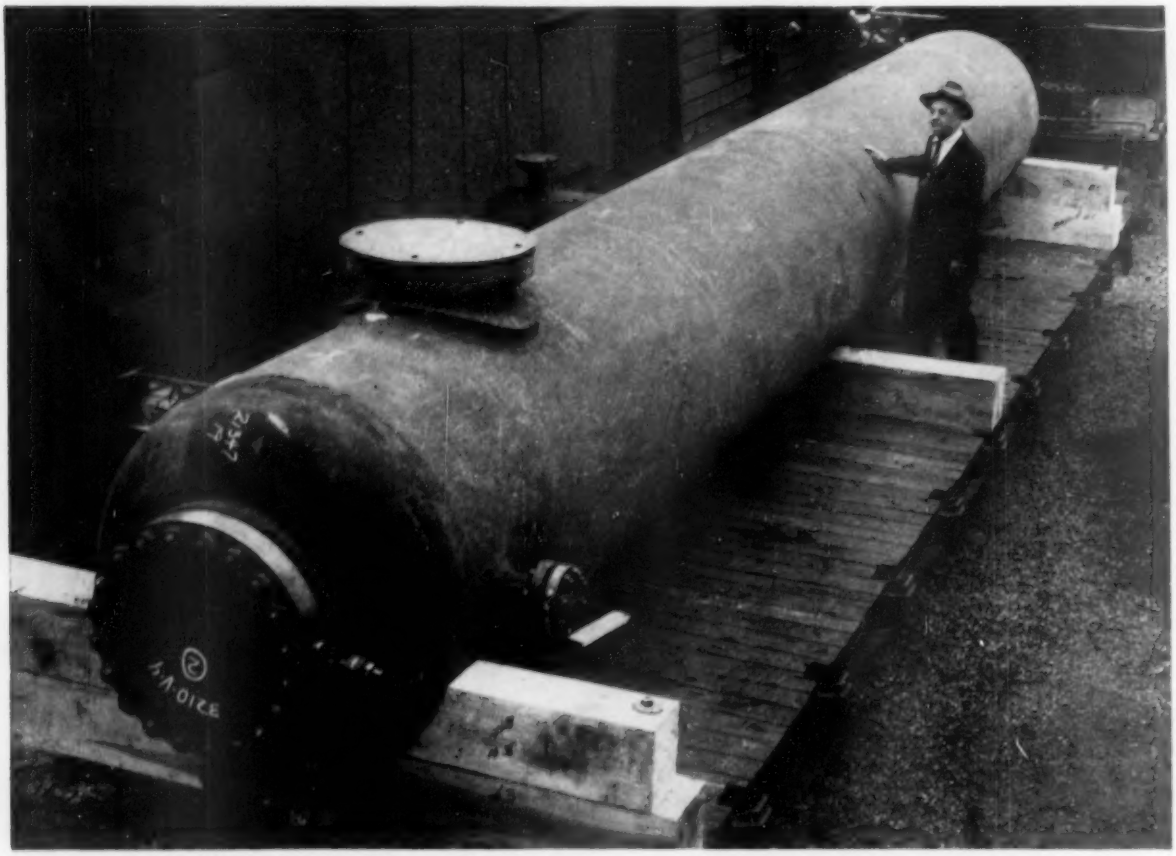


NEWPORT NEWS BUILT two 39'-7" horizontal gas scrubbers, such as this, for J. F. Pritchard & Co. They were made of ASTM-A212 Grade B fire box steel, with structural mesh steel interiors.

Gas scrubber made of 2⅞" steel

Newport News builds almost any type of pressure vessel and other heavy process equipment

Here is one of two horizontal gas scrubbers recently built for an operating pressure of 1800 psi at 300° F.

Newport News made both vessels from fire box steel, 2⅞ inches in thickness. We formed and automatically welded this steel into sections having a diameter of only 4 feet.

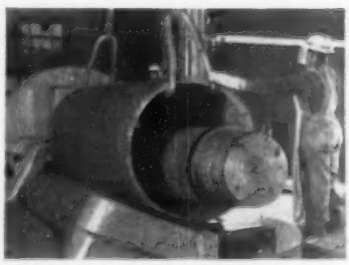
Rolling thick steel to this small diameter...no easy accomplishment, as you probably know . . . demonstrates the sort of jobs Newport News takes in stride.

Almost any type of heavy processing equipment is readily constructed by Newport News in a 225 acre plant comprising huge, fully equipped fabricating and machine shops, foundries, forge and die shops, heat treating and allied equipment as well as complete test facilities.

Newport News shop erection of fabricated units helps to speed assembly at your plant site.

Get a bid from Newport News on your present or future projects. Get the benefit of specialized production techniques. Look over the many ways in which Newport News can help you . . . write for "Facilities and Products", a very interesting booklet. It's yours for the asking.

ENGINEERS Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.



ROLLING 2⅞" STEEL for gas scrubbers. The steel, in a hot condition, was formed on the heavy bending equipment shown here. It will cold roll mild steel up to 3 inches thick, and will hot roll any grade of steel up to a thickness of 5 inches.

Newport News Shipbuilding and Dry Dock Company
Newport News, Virginia

should reach a new peak of over 29 million utility gas customers in 1955, in addition to 7.5 million LP-gas customers. Total revenues from the sale of gas will amount to nearly $3.5-billion this year, which also would be a new record, nearly 12.5 per cent ahead of the 1954 figure.

"The A.G.A. Bureau of Statistics predicts that by 1975, based on present rate of population increase and present per capita consumption of gas, our industry will be serving over 40 million consumers with about 170 billion therms of gas."

F. M. Banks, president American Gas Association, in address to A.G.A. annual convention in Los Angeles.

CALENDAR OF EVENTS

1956

JANUARY

9-13 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

16-18 Pipe Line Contractors Association eighth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

25-26 Northwest Petroleum Association, annual convention, Nicollete Hotel, Minneapolis.

25-27 Eleventh annual Symposium on Instrumentation for the Process Industries, Memorial Student Center, A. & M. College of Texas, College Station, Tex.

26-27 Fifth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

15-17 National Association of Corrosion Engineers Short Course for Pipeliners, Mayo Hotel, Tulsa.

19-23 American Institute of Mining and Metallurgical Engineers, annual meeting, Hotel Statler, New York City.

24 Natural Gasoline Association of America, Permian Basin meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Institute of Chemical Engineers, Statler Hotel, Los Angeles.

27-29 American Association of Petroleum Geologists, Rocky Mountain Section Auditorium, Denver.

MARCH

1-2 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

7-9 American Petroleum Institute, Division of Production, Southern District meeting, Plaza Hotel, San Antonio, Tex.

12-16 National Association of Corrosion Engineers, annual convention, Statler Hotel, New York City.

19-21 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

21-23 American Petroleum Institute, Division of Production, Southwestern District meeting, Texas Hotel, Fort Worth.

24 North Texas Oil and Gas Association, annual meeting, Wichita Falls, Tex.

APRIL

3-5 Annual Corrosion Control short course, University of Oklahoma Ex-

"talk about flow... this will be a real producer!"

With improved exploration techniques and improved drilling equipment . . . plus the ever spiraling demand for oil and gas . . . the New Year of 1956 should be a real producer! Joe Roughneck . . . heart of the petroleum industry . . . is certain to do one of the greatest jobs in his long and colorful career. Joe's efforts will be aided by his neighbor, Lone Star Steel . . . maker of top quality API casing, tubing and line pipe. Lone Star's big, completely integrated steel mill is dedicated to Joe Roughneck's team in the busy Mid-Continent area . . . and will deliver API pipe on the double.

Neighbor, wherever you are . . . specify Lone Star and we both get a good deal!

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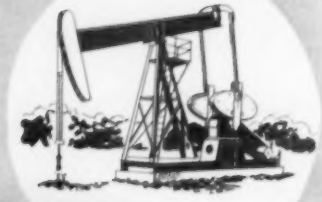
Tell us about the job and we'll tell you about a Century Motor with the power, the characteristics, and the experience to handle it.

Century specializes in tough electric motors for exacting oil country jobs and J&L Supply men understand their application. If the job is technical we'll work with your engineers, or we'll supply the engineering know-how.

Just get your J&L store on the 'phone.



Century Weathergard high torque, high slip motors start and handle pumping units with quiet efficiency in any weather your forecaster can dream up.

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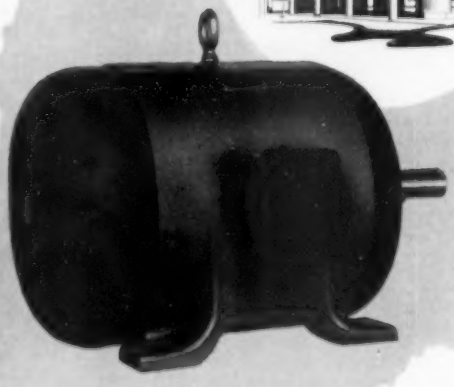

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tension Study Center, Norman, Okla.

4-6 American Gas Association, general management conference, Conrad Hilton Hotel, Chicago.

4-6 American Petroleum Institute, Division of Production, Mid-Continent District meeting, Broadview Hotel, Wichita, Kans.

8-13 American Chemical Society, general meeting, Dallas.

9-10 Texas Petroleum Research Committee, Ninth Oil Recovery Conference (Symposium on Natural Gas in Texas), Texas A. & M. College, College Station, Tex.

11-13 Natural Gasoline Association of America, Texas Hotel, Fort Worth.

14-15 Southern Gas Association, conference on use of electronic computers by engineering personnel, Hilton Hotel, El Paso.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel & Club, Boca Raton, Fla.

15-17 Texas Independent Producers and Royalty Owners Association, Statler Hilton Hotel, Dallas.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

18-20 American Petroleum Institute, Division of Production, Rocky Mountain District meeting, Cosmopolitan Hotel, Denver.

18-20 National Petroleum Association, semiannual meeting, Cleveland Hotel, Cleveland, Ohio.

19-21 Gas Appliances Manufacturers Association, annual meeting, The Greenbriar Hotel, White Sulphur Springs, W. Va.

23-25 Southern Gas Association convention, Dallas.

25-26 American Association of Petroleum Geologists and Society of Economic Paleontologists, annual meeting, Conrad Hilton Hotel, Chicago.

25-27 American Petroleum Institute, Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus, Ohio.

25-29 World Oil Exposition, Houston.

30

May 1 Independent Petroleum Association of America, semiannual meeting, Statler Hotel, Los Angeles.

30

May 4 American Petroleum Institute, Safety and Fire Prevention midyear meeting, Warwick Hotel, Philadelphia.

MAY

6-9 American Institute of Chemical Engineers, Roosevelt Hotel, New Orleans.

10-11 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.

10-11 American Gas Association, Gas Supply, Transmission, and Storage Conference, Conrad Hilton Hotel, Chicago.

14-17 American Petroleum Institute, Division of Refining, midyear meeting, Montreal.

16-18 American Gas Association, Chemical, Engineering, and Manufactured Gas Production Conference, Benjamin Franklin Hotel, Philadelphia.

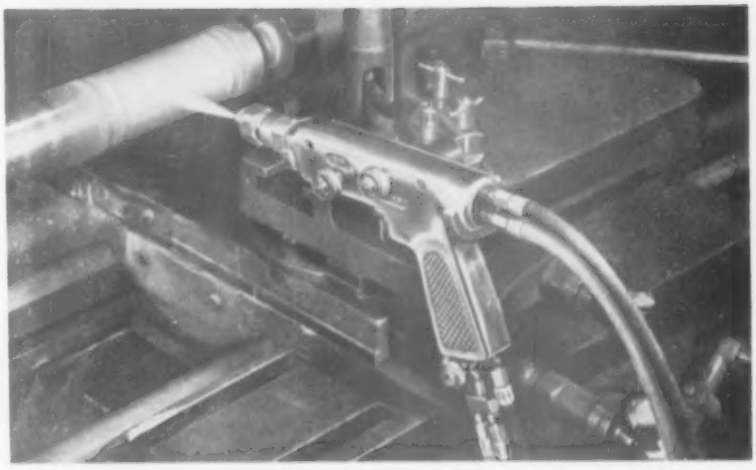
24-25 Natural Gas and Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont.

JUNE

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

24-25 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

STOP CORROSION



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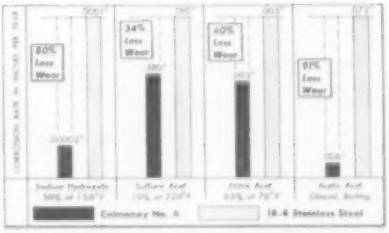
The superior corrosion resistance of Colmonoy No. 6 alloy makes it the ideal hard-facing material for use on metal-to-metal wearing surfaces operating under corrosive conditions.

The Colmonoy Spraywelder puts No. 6 on fast, in powder form. It makes smooth overlays within .010" of desired size, requiring a minimum of finishing. Sprayweld overlays are solid, non-porous, and welded to the base metal.

The corrosion of vital process equipment parts becomes needless waste when the wear resistant qualities of Colmonoy No. 6 are combined with the economy and ease of the Spraywelder. The answer to such waste by more and more cost conscious companies is "Stop corrosion with Colmonoy."



This table shows the comparative resistance to corrosion of Colmonoy No. 6 and 18-8 stainless steel. No. 6 is resistant to almost all caustics and acids. Ask for Engineering Data Sheet No. 3.

Write today for the Sprayweld Catalog and for Colmonoy Hard-Facing Manual No. 79, which describes all the Colmonoy hard-facing alloys and methods.

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for utmost corrosion—resistance, top quality and long-lasting performance you can't beat

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

How to Beat the Gas Rap

HERE'S an idea that's worth millions of dollars, but keep it confidential until we see what Congress does.

If the Harris bill is defeated and the Federal Power Commission gets unquestioned authority to regulate production of natural gas, we're going to get into the gas-producing business. We've figured out a way to beat the federal rap.

Here's the lowdown: If the Harris bill passes, pipelines can pay only reasonable field prices for natural gas. But if the bill doesn't pass, then FPC will treat gas producers like a public utility and fix prices on a cost basis.

Most gas producers say this will ruin them. It probably will ruin a lot of those already in business, but look at what a golden opportunity it offers to those just starting out!

We intend to go out and drill a whole bunch of wells looking for gas—just wildcat all over the landscape. What do we care how much it costs, or how many dry holes we get? Finally we bring in a couple of fair-to-middling gas wells, and we're ready to do business. We form a corporation and make a 20-year contract to sell the gas to an interstate pipeline.

We accept whatever field price is offered, but as soon as the deal is sewed up and gas starts moving, we start moving too. We apply to the Federal Power Commission for an increased price, shouting that the pipeline is taking our property without adequate compensation. You see, we are now a public utility, and entitled to earn our cost plus 6 per cent.

So FPC audits our books, adds up all our dry-hole losses and other expenses, divides it by the piddling volumes of gas we are selling, and concludes that our proper price should be, say, 50 cents or $1 per cubic foot. The pipeline—and its customers—have to pay, because that's the way public-utility regulation operates.

The next well we drill turns out to be a whooper-dooper. We discover a big new gas field on the first try—lots of gas and very little expense. Do we sell this gas to an interstate pipeline too? Don't be silly. The FPC would average off this low-cost gas against our other high-cost gas, and our total price would be maybe only a dime per M.c.f.

No sir! We form a separate corporation to own this low-cost gas, and we sell this gas to a local industry, or community, or to a pipeline that doesn't run outside of the state. Then we aren't in interstate commerce and aren't a public utility, and the FPC can't touch us with a 10-ft. pole. We can get 10 or 15 cents at the wellhead for intrastate sales, but since our cost is only a couple of cents a thousand in this field we ride the gravy train.

Pretty smart, eh? But keep it under your hat for the time being. Of course a lot of oil and gas men are going to be doing the same thing, but we don't want those eastern politicians and local gas distributing companies and other opponents of the Harris bill to get hep or they might drop their opposition. (They'll never figure it out for themselves, because they don't know that much about the gas business.)

But if the Harris bill passes, our game is up. Then all we could get for our gas would be a reasonable price, no matter what our costs, and we'd have to average our bad wells against the good ones in order to break even.

Of course after a couple of years of this, those easterners may begin to wonder why it is that they get nothing but high-cost gas, while the people down in the gas-producing states get all the low-cost gas. Then they may wish they hadn't killed the Harris bill.

But it will be too late then. By that time there will be both interstate and intrastate pipelines all through the producing fields. The high-cost leases will be connected to the interstate lines and will be collecting their cost-plus-6-per-cent as public utilities. The low-cost leases will be connected to the intrastate lines, and their price will be set by competition.

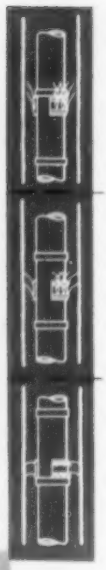
Isn't it wonderful? But please, please, don't let this word get back East. Our scheme will be ruined if the FPC is kept out of things and field prices for both interstate and intrastate sales are set by competition.

—Henry D. Ralph.

HERE'S WHAT BAKER

Controlled SCRATCHING

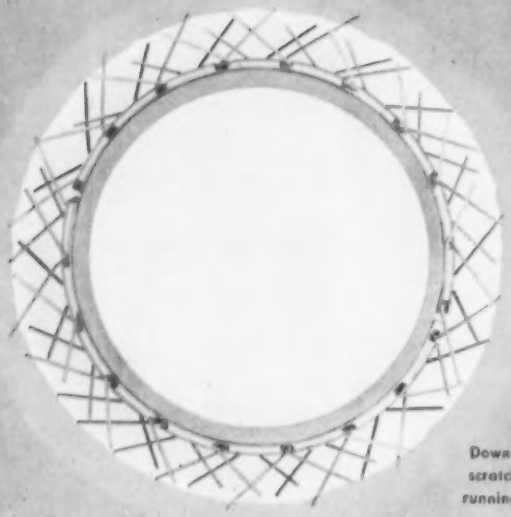
CAN DO FOR YOU!



When running in the casing string . . . the scratcher wires pass readily through sections which are *not* to be cemented, without damaging the vital filter cake.

When lifting the casing out of the slips . . . the scratcher wires do not attack the mud cake because the entire scratcher assembly remains stationary due to the three-foot interval between stop rings.

Only when the "scratching operation" is begun . . . by raising the casing a distance greater than the spacing between the stop rings, do the scratcher wires open outward and start to remove the mud cake.

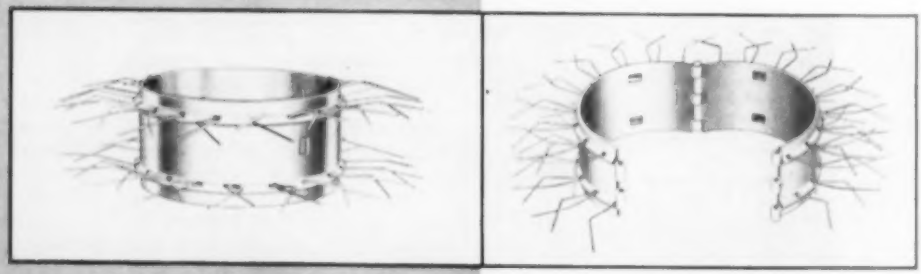


Down view shows scratcher wires in running-in position.

BAKER "Controlled Scratching" means effective removal of the mud cake, but ONLY in the areas to be cemented, where the original formation is exposed for better bonding of the cement.—The expensive filter cake—vital to the successful completion of your wells—is left virtually undisturbed in ALL areas outside of the cementing area. The strong "double-shell" construction, and the "fold-back" wires permit the scratchers to arrive *at the cementing point* in *good operating condition*, and then the overlapping wires effectively remove the mud cake over the 360-degree surface of the well bore.

Available with 4½-inch long (C-45) scratcher wires, or 2½-inch long (C-25) wires, one exactly right for your specific casing program. Contact the Baker representative in your area for helpful recommendations.

Baker Model "C" SOLID RING Wall Scratchers, Product No. 901-C, are merely slipped over the casing and positioned between two properly spaced stop rings.



Baker Model "C" HINGE-LOK Wall Scratchers, Product No. 900-C, are closed around the casing and the hinge is locked with a special knurled closing pin.

BAKER | **WALL SCRATCHERS**

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

How to get a happier new year

THE new year opens with industry leaders voicing pleas for unity, cooperation, and a broad view among the various elements of the oil and gas business.

Such is certainly needed if the industry is to present a united front and successfully ward off the many attacks on it in Washington and elsewhere. But this requires more than words. A certain amount of compromising of individual advantage is necessary.

HERE ARE EXAMPLES of current situations dividing the industry but which could be cured without undue sacrifice:

• Imports. If imports were held close to the 1955 level, say 1,250,000 bbl. per day, instead of going up by the forecast 6.6 per cent, domestic production could increase by around 4.5 per cent instead of 3.5 as now is indicated.

This is not as much as many producers want, but the increase, plus the cooperative spirit exhibited, would wipe out most of the grumbling and dissension among producers. It might also stiffen the entire market enough to eliminate many of the present sore spots.

• Prices. Producers have been saying for some time, and with increasing frequency and emphasis of late, that the price of crude oil is below the cost of replacement. Nobody has refuted that claim. But recently the heads of two of the largest majors flatly stated that an increase in crude prices is out of the question.

It is true that a higher crude price would hit some refiners hard and that chaotic marketing conditions in some areas make price increases almost impossible at this time. But it is also true that most refiners and marketers admit that crude prices may have to rise in the near future and are beginning to prepare for it.

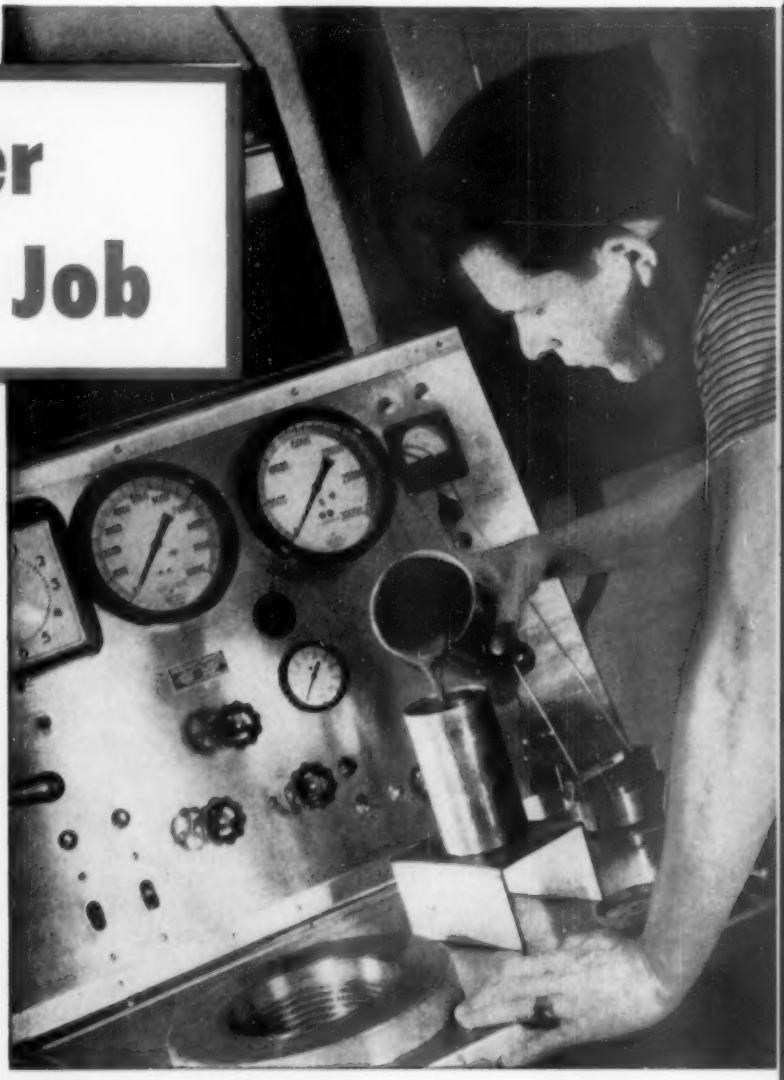
• Gas. Producers fighting for their lives have already made many compromises in accepting the provisions of the Harris bill as amended in the House. Yet several of the big transmission companies are neutral or even quietly aiding the bill's opponents.

Opposition to the creeping socialism of federal control should be a matter of principle, but producers feel that some gas companies see an advantage for themselves by letting their suppliers be hamstrung or forced into bankruptcy by utility-type regulation.

UNITY AND COOPERATION the industry does need badly. But the "one for all and all for one" spirit necessarily involves more give and take than a good many elements of the industry seem ready to put into practice. The industry can't speak with one voice unless some of the causes of internal friction are removed.

BAKER | **BAKER OIL TOOLS, INC.** HOUSTON • LOS ANGELES • NEW YORK

For a Better Cementing Job



● Scratchers and centralizers illustrate the use of modern equipment in the field, for the purpose of overcoming adverse conditions down the hole.

To the same end, modern equipment employed in Oil-Well cement research—using A. P. I. testing procedures—makes it possible closely to simulate pressures and temperatures down the hole, and thus to produce cements for trouble-free cementing jobs.

This intensive laboratory research, based on continuing study of changing field conditions, keeps Lone Star Cements abreast of the times to meet the most exacting Oil Industry requirements.

Standard Oil Co. (N.J.) Photo

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Select Cement to Fit the Job!

Current and significant in . . .

The Industry This Week

Production

• **The free world's crude-oil output,** exclusive of the U. S., reached the all-time high of 7,181,300 bbl. daily in October.

Main factor in this record is stepped-up production in Venezuela, Kuwait, and Saudi Arabia, the three leading crude exporting countries. P. 62.

Unitization has become effective for Colorado's Adena field, largest in the Denver-Julesburg basin. The unit operation, along with new spacing rules and production limits, is expected to add 10,000,000 bbl. to primary recovery. P. 60.

Pipelines

• **It won't be long till the Little Big Inch** is back pumping products again. June 1 is the target date to finish converting the war-emergency products line which has been carrying natural gas. Texas Eastern is going ahead rapidly with the project, which will have semioutdoor, single-unit, remote-controlled pump stations. P. 56.

Pacific Northwest is working on the last half of its 1,466-mile natural-gas pipeline. Construction has been moving at a record clip, despite heavy snow and delays in pipe deliveries. The line should be ready to move San Juan basin gas to the Northwest next summer. P. 51.

Transok has completed its 24-in. natural-gas line from near Lindsay, Okla., to Public Service Co.'s Tulsa power plant. Public Service lined up a 25-year gas supply by buying direct from the producers. P. 59.

Drilling

• **The world's deepest well is reaming ahead** slowly below 20,700 ft. Richardson & Bass is proceeding cautiously to avoid any further caving. Oil and gas are still being circulated out of the Louisiana test, which the operator hopes to complete next month as the world's deepest producer. P. 57.

A big name in contract drilling is dropping out of the Pacific Coast picture. Thomas P. Pike Drilling Co. is quitting business. Republic Supply of California, with which the Pike family is connected, will acquire 16 of the 18 domestic rigs owned by the drilling firm. Republic will use them in its rental and sales business. P. 51.

Gas Liquids

• **The L.P.G. industry has just closed the books on its biggest year.** And it's looking ahead to an even bigger one in 1956.

Sales edged above 6,000,000,000 gal., boosted by an increase of 880,467,000 gal., biggest in history. The synthetic-rubber market had the sharpest rise, but domestic and motor-fuel uses remained the biggest outlet, accounting for over 60 per cent of all sales. P. 52.

Natural Gas

• **Another big year for the gas industry is seen by A.G.A.** in its year-end review and forecast.

Association expects $1.2 billion to be spent on new construction and expansion this year, almost as much as in 1955. It sees a total outlay of $4.3 billion through 1958, including 1955's $1.39 billion expenditure. P. 58.

Indianapolis Mayor Alex M. Clark takes over as head of a committee in Washington to fight for passage of the Harris bill.

Clark says the group, the Joint Committee of Consumers and Small Gas Producers, will answer with facts the "unrealistic and irresponsible propaganda" being spread by distributors.

Oil Has Vital Stake in New Congress

- Political scrap between Democratic-controlled Congress and Republican administration may catch oil in crossfire
- Harris bill, changes in depletion allowance, taxes aren't the only issues coming up vitally affecting petroleum

Bertram F. Linz

WASHINGTON. — Issues vitally affecting the oil and gas industries come to the fore this week as Congress opens its 1956 session.

Federal control of natural-gas producers, the depletion allowance, imports, and taxes are major, but not the only, subjects that may come up in the next 7 months.

With a presidential election coming up in November, the session promises to be a long, no-holds-barred fight between the Democratic-controlled Congress and the Republican administration. And much of the time oil will be smack in the middle.

The exact legislative program is still to be worked out. President Eisenhower's recommendations will be revealed in a series of messages over the next 2 or 3 weeks. Democratic leaders will write their own ticket. A strong effort is being made to get the Harris bill well toward the top of it.

So many problems face Congress that some will have to be sidetracked if it is to adjourn before the national conventions in August. But the major oil issues are expected to be taken up. And the first to be considered probably will deal with the Federal Power Commission's control of natural-gas producers' prices.

The Harris bill . . . The Harris bill barely squeaked through the House last year. It is ready for final Senate action. It is an issue which is likely to start a bitter party row.

The measure is in a critical spot. If it gets through the Senate, it probably will be by a narrow margin. But to go to the White House, it must be passed without any amendments to which the House might object. Experienced observers say that if any amendment makes it necessary to send the bill to conference it will never come out. Election-year jitters will kill it.

The bill has split both parties right down the middle. But the spotlight is on the fight on the Democratic side of the aisle. It could trigger other rows that could breach the unsteady peace between southern and northern Democrats.

Majority Leader Lyndon Johnson of Texas will make a stiff fight to get the bill passed. But Sen. Paul Douglas of Illinois and a group of followers from the consuming states will make just as stiff a fight to kill it. The Douglas forces will have a lot of support from back home, generated by the newly formed Council of Local Gas Companies.

The strategy of the opposition will be to either talk the bill to death or so load it with amendments that it must go to a conference committee.

Depletion . . . What may happen to the percentage depletion allowance is anybody's guess until the Treasury makes its tax recommendations.

In past years the Treasury has repeatedly recommended a reduction in the rate. Congress has never gone along with the idea. Last year President Eisenhower said in a message the matter was under study. Secretary Humphrey has carefully avoided giving any indication of his views, but is expected to disclose them within the next few weeks.

A joint economic subcommittee held hearings on various tax issues, including depletion, last month. This group cannot write any bills, but its report and recommendations will carry weight with the House ways and means committee and Senate finance committee. These two committees will handle the tax bill.

The subcommittee's hearings were based on papers prepared by a seven-man panel on depletion set up last spring. Four businessmen and three economists comprised the panel. The economists unanimously attacked the allowance. But all agreed the extractive industries required special tax treatment, although they did not agree on the form it should take.

Other taxes . . . Depletion will be the most important tax question so far as the industry is concerned. But it has a stake also in the corporation tax and the excise taxes on oil. Whether the long overdue reduction of the corporate tax from 52 to 47 per cent and the repeal of the emergency increase on gasoline will finally be made will depend upon the financial position of the Treasury.

Administration and congressional leaders have indicated that tax relief for individuals will be the first aim. That could cost the Treasury some $3 billion in revenue. Whether the tax cut could extend to, say, a 50 per cent rate for corporations will depend on how the Treasury figures its June 30 position.

Imports . . . Import controls undoubtedly will be discussed during the session. Whether any effort is made to get legislation on the subject will depend on the success of Mobilization Director Arthur S. Flemming in securing voluntary restrictions.

Flemming recently said that residual imports have been brought into line with the recommendations of the Cabinet fuels committee. But he has indicated that if his effort to secure a 7 per cent cut in crude imports from areas other than Venezuela and Canada fails he will invoke the national-defense provision written into the Reciprocal Trade Act last year.

That provision allows the President to take any steps he deems necessary to limit imports that threaten industries essential to the national defense. It was a compromise between the demands of the domestic oil producers and coal interests for quotas and the opposition of the State Department to any controls whatever.

Those are the issues affecting oil. But there are a number of bills in which the industry has an interest:

. . . Synthetic fuel: Rep. Carl Vinson of Georgia, chairman of the House armed-services committee, didn't favor the closing of the Interior Department's oil-shale research at Rifle, Colo. Interior officials suggested it might be possible for the Navy to pick it up. Vinson last session introduced a bill to that effect, which he may press this year.

The Navy was not consulted about the matter and has made no recommendations. But it would be willing to carry on the project because of its big holdings of shale and indications that Union Oil Co. has slowed down its timetable for getting into commercial production.

Navy studies lead to a belief in the department that with an annual appropriation of $1,250,000 to $1,500,000 the design for a commercial retort and improved methods of mining shale could be developed in 5 years.

SEN. LYNDON B. JOHNSON
. . . Will quarterback the industry's team.

SEN. JOSEPH C. O'MAHONEY
. . . Has some ideas about investigation.

. . . Transportation policy: A cabinet committee recommended last year that the railroads be freed to write their own rates so they could compete more effectively against the motor carriers.

The for-hire truckers are bitterly opposed to a policy which they say would enable the railroads to kill them off by quoting low freight rates which would skyrocket as soon as competition was eliminated.

It is expected that congressional committees will go into the matter.

. . . Highways: The administration's bill for a 10-year, $101-billion, road-building program was snarled last year by the fight over how it should be financed.

At that time the administration was pressing for a special bond issue. That idea apparently has been dropped and Eisenhower will go along with a pay-as-you-go program. This would require tax increases, probably including a 1-cent gasoline tax.

. . . Waterways: There will be talk, if no action, on the idea proposed last year to apply tolls to users of inland waterways improved with federal funds. The oil industry is a big user of water transportation and will line up with the opposition. In 1954 more than 64,572,000 tons of crude and nearly 204,000,000 tons of products were moved by water from one point to another within the U. S.

. . . Social security: Further expansion of the social-security program is under study. This would include a lowering of the age at which women workers could retire and the bringing of several million workers not now covered into the program.

. . . Robinson-Patman Act: There is still sentiment for a tightening of the law against price discrimination. But in view of the heavy program, it is seen more likely to be confined to committee investigation than to a specific bill.

. . . Federal aid to education: The Supreme Court segregation decisions have made this a hotter-than-ever issue. But it is realized that there are deficiencies in our educational system due to lack of state funds. This has been developed by studies showing a shortage of scientific and technical personnel in the oil (a big employer in this field) and other industries.

. . . Taft-Hartley Labor Relations Act: Revision of this law—if nothing more than a dropping of the authors' names—will be one of the first objectives of the newly merged A. F. of L.-C. I. O. But But there is no expectation that any bills will be passed this year.

A number of oil bills introduced last session are still alive. But there are none of any great importance and few will be heard of this year.

Investigations planned . . . Industry relations with Congress will not be confined to legislation. A number of investigations are planned and more will be listed as the session goes on. Some will be politically slanted. Others will be anti-big business. Here is what already is lined up:

. . . National Petroleum Council: A House judiciary subcommittee headed by Rep. Emanuel Celler of New York plans to probe the make-up and activities of the NPC this month.

This is part of an investigation which has been going on for some time into the activities of men serving the Government without compensation. The inquiry into the council may also bring in industry men who served in the Pe-

troleum Administration for Defense and Interior's Oil and Gas Division.

. . . Pipelines: A House armed services subcommittee headed by Rep. F. Edward Hebert of Louisiana started an inquiry into the proposed West Coast pipeline last session.

Hebert plans to continue his study. He will call top Defense officials to explain their opposition to the project. He will also question Mobilization Director Flemming, and with him may get into the question of an emergency pipeline to the East Coast.

. . . Elk Hills: Standard Oil Co. of California may have a chance to explain its plan to trade off its oil and get out of the Elk Hills naval petroleum reserve. This would come when the House armed-services committee holds its annual hearing on the administration of the reserves by the Navy.

The Navy Department has never passed officially on Standard's proposal. It won't make any effort to arrange a deal until Vinson's committee lays down the conditions to be met.

. . . Tankers: Plans to get a number of supertankers built for long-term charter by the Military Sea Transportation Service haven't worked out. Vinson's committee may go into the matter. He favors the Government building tankers if the industry won't come through.

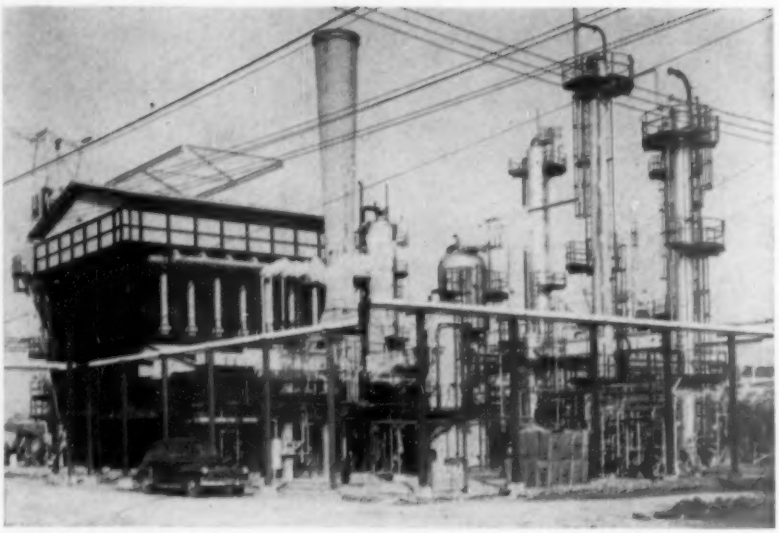
. . . Oil industry: Sen. Joseph C. O'Mahoney, holding hearings on General Motors, has dragged oil in several times. He said last month he was interested in an all-out study of the oil industry, but wants to do it in the Senate interior committee, of which he is a member and chairman of a subcommittee.

. . . Price discrimination: Sen. Hubert H. Humphrey of Minnesota, chairman of a Senate small-business subcommittee, plans to call on the Justice Department and Federal Trade Commission to explain their enforcement of the Robinson-Patman Act ban on price discrimination.

. . . Dealer relationships: House and Senate small-business committees are expected to continue probes into the relations between gasoline retailers and their suppliers.

. . . Compact and synthetic rubber: The Justice Department next spring is to make reports to Congress on the Interstate Oil Compact and the synthetic rubber industry.

The compact report is to show whether the agreement is being used to control prices or production. The rubber report is to advise whether the new private industry operating former government-owned plants is living up to the antitrust requirements of the sales contracts. Either report could trigger a congressional investigation.



SOHIO PLANT points up use of reformer hydrogen, buildup in urea capacity as . . .

New Trends in Petrochemicals

BYPRODUCT hydrogen from catalytic reforming is assuming a larger role in the synthesis of ammonia—king of the inorganic petrochemicals.

With a comparatively cheap supply available from the boom in reforming, this refinery process is taking its place beside natural gas as a major source of hydrogen.

Along with this petrochemical trend there is another: the continued growth in urea capacity, even though capacity has already outstripped demand.

Urea, which is made from ammonia and carbon dioxide, is used principally in agriculture. A primary outlet is high nitrogen-content fertilizers. But it has other uses in urea-formaldehyde and urea-melamine resins, textile finishing, pharmaceuticals, and cattle-feed supplements.

Continued expansion in urea reflects confidence that there's a good future market in the form of liquid fertilizers and in industrial uses such as urea-melamine resin.

Hydrogen from cat reforming . . . Three ammonia plants based on cat-reformer hydrogen have already been completed and three others are building.

The existing plants are Sohio Chemical Co., Lima, Ohio; Atlantic Refining Co., Philadelphia; and Shell Chemical Corp., Pittsburg, Calif., the latter supplied by the Martinez refinery.

Calumet Nitrogen Products Co., Hammond, Ind., will use hydrogen-rich cat-reformer gas from East Chicago and Whiting refineries. This project is a joint venture of Sinclair Refining Co., and Standard Oil Co. (Ind.). Standard Oil Co. of California is building one at Richmond, Calif., and Sun Oil Co. is building the other at Marcus Hook. St. Paul Ammonia Products Co. is planning an ammonia plant in the Twin Cities area, based partly on hydrogen from the Great Northern refinery.

Five plants are now manufacturing urea, with Sohio's being the first to incorporate the Swiss-developed Inventa process.

The Pechiney process is employed by Allied Chemical & Dye Corp., at Omaha, Neb., and South Point, Ohio, and by Deere & Co.'s Grand River Chemical Division at Pryor, Okla. Du Pont has its own process at Belle, W. Va.

Shell Chemical Corp. will incorporate the Montecatini process in its Ventura, Calif., unit now under construction. Two other urea plants are scheduled: Southern Nitrogen Co., Savannah, Ga., and Thunderbird Chemical Co., Kyrene, Ariz.

Both the increased use of cat-reformer hydrogen and the buildup in urea capacity are underscored by Sohio's Lima plant, which has just gone on stream.

Marking the petrochemical debut of Standard Oil Co. (Ohio), parent company of Sohio Chemical, the $17,000,000 plant is building up an inventory of aqua ammonia, urea ammonia solutions, ammonium nitrate solutions, and nitric acid. First shipments of these chemicals have already been made.

Urea deliveries will start in February and the dry-ice unit, still under construction, will be in production next May.

Merger Tide Rising

Trend is toward big-company buying of small firms; it's cutting down on competition, judiciary committee warns

WASHINGTON.—The growing number of corporate mergers is rapidly reducing competition in industry and contributes in large measure to the growing concentration of economic power, a House judiciary subcommittee warned last week.

In the oil and gas industry, 32 companies were acquired by 21 others during the period from 1948.

Over 3,000 concerns have disappeared in the swelling merger tide since January 1951, the subcommittee disclosed. The trend toward concentration has been rising rapidly, and at the end of 1954 mergers were being made at three times the rate in 1949.

Merger activity is due more largely to big corporations buying up small businesses rather than to small businesses consolidating in order to compete more effectively with larger concerns, the subcommittee found.

In the oil and gas industry, study showed that 18 of the companies acquiring others had assets in excess of $50,000,000 and another 11 were in the 10 to 50-million-dollar class.

More vigorous enforcement of the antimerger laws was demanded by the subcommittee. The Justice Department and Federal Trade Commission, it charged, have made only a "token gesture" at enforcement. If this is due to lack of funds, it said, appropriations should be increased.

The subcommittee approved the policy of the FTC and Justice Department of conferring with parties to a merger and indicating whether it would be in violation of law. But it suggested these policies may go beyond the authority of the two agencies, and perhaps should be formalized by amendments to the law.

These acquisitions were listed for the subcommittee by the Federal Trade Commission:

1949

Prunty Production Co., Ponca City, Okla., acquired by Cities Service Co. through Cities Service Oil Co.

New York State Oil Co., Inc., New York and Wichita, Kans., and Consolidated Gas Co., acquired by Phillips Petroleum Co. through West Edmond Oil Co.

Allied Iron Works, Inc., Chester, Pa., acquired by Standard Oil Co. (Ind.) through Stanolind Oil & Gas Co.

Allied Oil Co., acquired by Ashland Oil & Refining Co.

Sloan & Zook, Bradford, Pa., acquired by Deep Rock Oil Corp.

Wil-Tex Oil Corp., Corpus Christi, Tex., acquired by Panhandle Producing & Refining Co.

De Large Oil Co., acquired by Texas Gulf Producing Co.

Healy Petroleum Corp., Bradford, Pa., acquired by United Refining Co.

1950

Freedom Valvoline Oil Co., Freedom, Pa., acquired by Ashland Oil & Refining Co.

Phillips Oil Co., acquired by Gulf Oil Corp.

General Oil Sales Co., acquired by Plymouth Oil Co.

Frontier Oil Refining Co., Buffalo, National Refining Co., Cleveland, a subsidiary of Mid-West Refineries, Inc., and Aetna Oil Co., Louisville, acquired by Ashland Oil & Refining Co.

Lisbon Gasoline Co., Inc., Shreveport, La., acquired by Sinclair Oil Corp., through Sinclair Oil & Gas Co.

Coastal Petroleum Co., a subsidiary of Peninsula Oil Leases, Inc., which is controlled by Pancoastal Oil Co., Caracas, Venezuela, acquired by Standard Oil Co. of California through American Bitumuls Co.

Barnsdall Oil Co. acquired by Sunray Oil Co.

United Geophysical Co., Inc., acquired by Union Oil Co. of California.

Sunset Oil Co., Los Angeles, acquired by Eagle Oil & Refining Co.

1951

Stoll Oil & Refining Co., Louisville, acquired by Sinclair Oil Co.

Ultra Penn Refining Co., Inc., Bruin, Pa., acquired by Borne Scrymser Co.

1952

Julius Hyman & Co., Denver, acquired by Shell Oil Co. through Shell Chemical Corp.

Kanotex Refining Co., Arkansas City, Kans., acquired by Anderson-Prichard Oil Corp.

Kirby Petroleum Co., Houston, acquired by Taylor Oil & Gas Co.

1953

Bryton Chemical Co., Trainer, Pa., acquired by Continental Oil Co., and Hugoton Plains Gas & Oil Co., Tulsa, acquired by Deep Rock Oil Corp.

1954

American Republics Corp., Wilmington, Del., acquired by Sinclair Oil Corp.

Lac Chemical, Inc., Culver City, Calif., acquired by Shell Chemical Corp.

Kirby Petroleum Co., Houston, acquired by Continental Oil Co.

Colorado Oil & Gas Corp., Denver, acquired by Derby Oil Co.

Louisiana Leases Offered

BATON ROUGE.—Oil and gas leases covering nearly 225,000 acres under Lake Pontchartrain will be offered by the Louisiana Mineral Board January 18.

The area covers most of the west end of the lake. It is being offered in 45 tracts ranging from about 1,150 acres to 5,000 acres.

The board also has invited bids on three offshore tracts in the West Cameron area. They will be offered for leasing February 15. The offshore acreage includes about 2,101 acres in Block 13; 1,127 acres in Block 14; and 4,560 acres in Block 17.

Industry BRIEFS

BARTLESVILLE, Okla. — Phillips Chemical Co., subsidiary of Phillips Petroleum Co., has announced the third expansion this year of its Plains synthetic-rubber and butadiene plants near Borger, Tex.

Phillips' buildup is typical of the entire industry which has been growing by leaps and bounds since government plants were purchased by private owners earlier this year.

Capacity of Phillips' rubber plant, listed at 63,000 long tons annually originally, will be increased by 30,000 long tons. The adjacent butadiene plant will be expanded by 24,000 short tons. Phillips previously announced expansions of 15 and 22 per cent.

SANTA MONICA, Calif.—Encouraged by the decision of Redondo Beach voters to allow tidelands drilling, General Petroleum Corp. has renewed its pact with neighboring Santa Monica to serve as contractor when and if the community approves such a project.

A measure, similar to the one approved November 15 by Redondo Beach, was defeated by Santa Monica a year ago. General Petroleum told Santa Monica civic officials that Redondo Beach drilling would pose a serious threat of drainage from oil pools which might lie off Santa Monica.

HOUSTON.—Levingston Shipbuilding Co., of Orange, Tex., has contracted to build a $1,500,000 drilling tender for the CATC Group. The vessel will be used in 15 to 100 ft. of water and will measure 260 by 54 ft. The tender will provide quarters for 50 men and store supplies needed in tidelands drilling. It will be completed by July 1956 and will be the fifth of its type built for CATC in 2 years.

HOUSTON. — Walter Kidde Constructors, Inc., has completed steel erection for Shell Chemical Corp.'s new resin development facility here. The unit should be ready for operation by April, turning out resins and related products for market development.

AUSTIN.—Gas producers in the Texas Panhandle are getting about 9 per cent more for their gas this year compared with 1954, the Texas Railroad Commission said last week.

The price in November averaged 8.9073 cents per M.c.f. at 14.65 psi., as compared with 8.1513 a year earlier. At 16.4 psi., the increase from last year was from 9.125 cents to 9.9713 cents. The Texas Panhandle field gas-price hearing is held semiannually. The next one is slated in Amarillo May 16, 1956.

SOUND-PROOFING AND LANDSCAPING are applied to derrick on movie-lot lease of Universal Consolidated to blend in with surrounding Beverly Hills residences.

Oil Lease Is Prettied Up for the Public

LOS ANGELES.—Here's a model oil lease—productive, pretty, and quiet as a kitten.

It's located appropriately, on a movie lot in Beverly Hills.

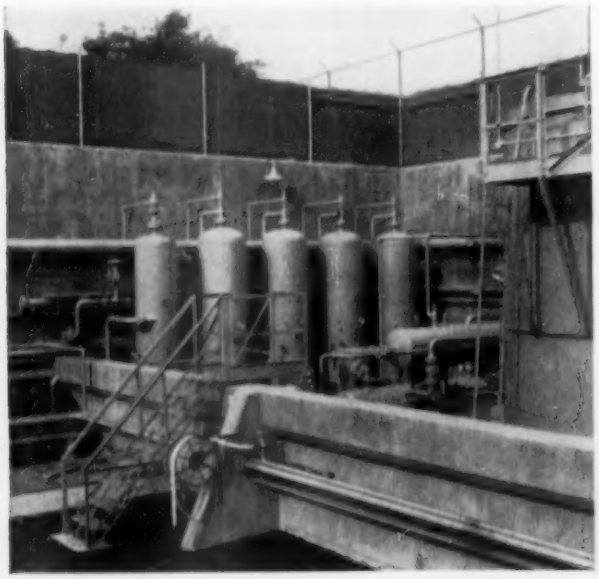
The 20th Century Fox lease, owned by Universal Consolidated Oil Co., is surrounded by a high-rent residential district. The drill site is just 100 yards off Olympic Boulevard. Bordering the area is the Beverly Hills High School campus.

Yet Universal is able to tap the oil pool below without offending property owners. How it is succeeding provides an object lesson for others who may want to drill under city homes.

The trouble here was that the city grew over the old Beverly field area in western Los Angeles before all potential oil structures could be tested. Universal tried to get a lease as far back as 1942.

But it wasn't until 2 years ago that the company persuaded city authorities to approve the 280-acre 20th Century Fox lease. Universal paid dearly to cut noise and beautify the drill site to keep the city happy.

It cost $3,000,000 to drill seven



RETAINING WALL, reinforced with steel, forms backdrop for gas traps and shipping tanks on 20th Century Fox Lease.

PLASTIC COATING on derrick shields nearby school, homes from drilling noise. Gas dehydration facilities are in the foreground.

wells and put them on production. The soundproofing and landscaping added about 75 per cent to the cost per well. But the price was worth it.

Those seven wells are flowing 3,000 bbl. of 27° crude daily and 6,000 M.c.f. of gas through restrictive chokes.

Production is from three known zones—5,300 ft., 7,000 ft., and 7,903 ft. A gas zone at 4,800 ft. is behind pipe. Tests indicate the possibility of another oil zone at 6,800 ft. Flow is from Miocene sands associated with the Inglewood fault.

Cellars at the drill site have been prepared for only 14 wells, but 40 can be drilled directionally using 10-ft. spacing.

How Universal pleased city . . . Universal went to considerable length to make its operations palatable to city fathers and citizens.

The 136-ft. derrick and all power units are completely enclosed. They are insulated with fireproof vinyl plastic cloth 1½ in. thick. All phases of drilling and production are powered by electricity. The combination of electric drilling and plastic insulation makes the operation very quiet. Street sounds a block away are noticeably louder than the drilling noise even when standing next to the rig.

The drill site, in a slight depression, has steel reinforced walls on two sides.

Cuttings and discarded mud are hauled away in vacuum trucks. All trucking must be done during the daytime. Drill pipe cannot be taken from pipe racks after dark. If the driller runs out at night, he has to shut down.

With these restrictions, it is understandable that costs have soared. Drilling time per well has averaged 75 days on the seven completions.

Union pioneering helps . . . Union Oil Co. set the pattern for this type of operation with its Sansinena field development in La Habra.

Universal studied the Sansinena project extensively while preparing its 20th Century Fox lease plans. Even the colorful language of drilling crews came under restriction at Sansinena lest they offend someone in residences just a stone's throw from the rig.

Union drilled 106 producing wells from 12 subsurface sites, using the directional method.

The pioneering done by Universal and Union in these projects may help destroy the public's idea that residential drilling leads to such eye sores as the old familiar wooden derricks at Signal Hill and other nearby fields. As a result, future leases in residential areas may be easier to negotiate.

Pike Drilling Quitting Business

LOS ANGELES.—Thomas P. Pike Drilling Co. of Los Angeles, one of the most active contract drillers on the Pacific Coast, is quitting business next month.

Republic Supply Co. of California will acquire 16 of the 18 domestic rigs owned by Pike. Transfer will take place when the equipment has finished present contracts in February.

The supply concern announced it will use the rigs and equipment to expand its oil-field drilling equipment rental and sales business. Republic does not plan to enter the contract-drilling field.

Pike announced that one company rig now in Uruguay will continue to operate under Dunlap and Graham, Inc., a subsidiary of Pike.

Two of the domestic Pike rigs will be acquired by S. I. Williams and H. G. Haney, president and vice president of the Pike firm. They plan to start a new drilling firm after the deal with Republic is completed.

S. I. WILLIAMS

H. G. HANEY

The Williams & Haney Drilling Co. will start operations in California with plans tentatively to expand later from two to five rigs.

Neither Pike nor Republic officials elaborated on factors prompting the deal. Williams and Haney are minority stockholders in Pike Drilling and reportedly accepted the two rigs to settle their equity. The Pike family holds substantial interests in both Pike Drilling and Republic Supply of California.

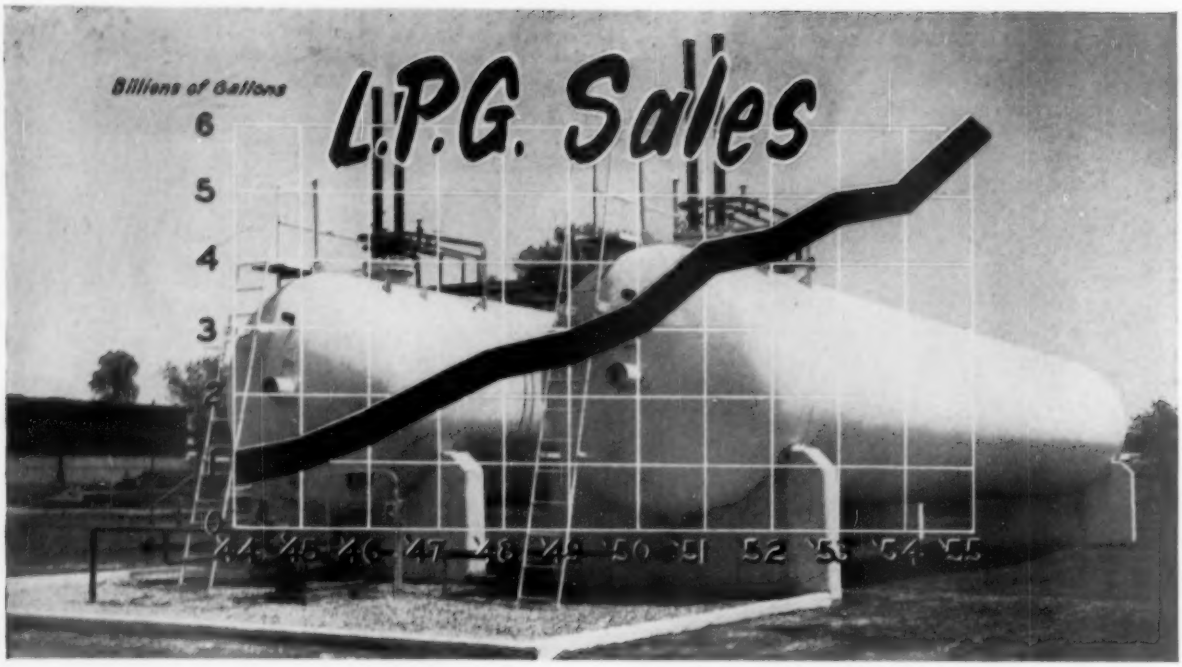
Pacific Northwest Over Half Finished

THE 1,466-mile natural-gas line being built by Pacific Northwest Pipeline Corp. is half finished, and the construction pace is being stepped up by Fish Northwest Contractors, Inc.

The crew shown here is wrapping 22-in. pipe with asphalt tar and fiber glass to protect it against corrosion. This spread is on the eastern Oregon portion of the line, which will bring San Juan basin gas to the Pacific Northwest.

Less than 8 months after financing was completed, Pacific Northwest had 750 miles of 26-in. and 22-in. in the ground. Nine construction spreads and seven river-crossing crews will be joined by spreads of four more contractors in Washington as the pipeline moves toward completion next summer.

Biggest obstacles so far have been snow and delays in pipe delivery caused by strikes at two plants. Probably the toughest pipe laying has been on a short stretch of sharp, rocky peaks over the Cascades from west of Goldendale, Wash., to Bonneville Dam. In 10 miles from Mack, Colo., into Douglas Pass, the line rises 5,000 ft. to 9,000 ft. elevation. At one spot it climbs 2,000 ft. in half a mile.



L.P.G. Chalks Up Record Gain in '55

- Sales increase fivefold over 1944 figure, move above 6-billion-gallon mark for first time
- Outlook is for an even better year in 1956, although utility market continues to fade

LIQUEFIED petroleum gas sales enjoyed another phenomenal year in 1955. Volume was the biggest in history—6,006,000,000 gal.

The 1955 increase was the biggest in the industry's 33 years—880,467,000 gal., or 17.2 per cent.

Production capacity, storage, and transportation expanded accordingly. And 1956 is expected to be another spectacular growth year, even with tough competition in many areas from natural gas, and in spite of unsolved storage and transportation problems resulting from the uneven summer-winter demand.

This is the picture presented by Phillips Petroleum Co. in its annual L.P.G. summary. Phillips, a leader in the L.P.G. industry, has prepared annual summaries since 1920. This year's study was made by George R. Benz, engineering department manager; Paul W. Tucker, technical representative; and W. F. DeVoe, assistant to the sales manager.

The outlet for synthetic-rubber components set the pace percentagewise. This category was up 56.3 per cent to 481,000,000 gal. under the impetus of record auto production and private ownership of the government-built plants.

But domestic and motor-fuel uses continued to be far and away the biggest markets. Sales were up 15.3 per cent to 3,661,000,000, or some 61 per cent of the industry total. It is also these markets—home heating, motor fuel, and weather conditioning—that are believed to hold the greatest potential for future growth.

Only in gas manufacturing, the smallest single category, are sales declining. The drop of 10.9 per cent to 171,000,000 gal. continued the slide started in 1951 for this utility use. The reason is a swing to natural gas.

Capacity, storage, transportation . . . Sales are being spurred by a rapidly growing supply, with 22 new plants being added the past year.

They added some 850,000 gal. per day to production capacity. And 500,000 gal. daily should be put on stream this year. An increase in the market price would spur the recovery of still more L.P.G. from existing plants, the Phillips study said.

Underground storage amounts to 602,700,000 gal., and an additional 292,000,000 gal. is either building or planned. These projects would raise capacity to 894,700,000 gal., not including above-ground steel storage, which also is being expanded.

Most underground storage now is in salt beds or domes. The first chalk cavern for this purpose is being completed, and one is planned in solid granite.

If L.P.G. is to realize its greatest potential, in such markets as the upper Midwest and in the Atlantic Seaboard states, economic storage must be found near consuming centers. Then large-scale pipeline movement will be justified.

As the demand keeps going up, transportation facilities are being expanded. Seven products pipelines which will handle L.P.G. were planned or building last year. A new ocean-going L.P.G. barge was added to the fleet, and a tanker is being completed for service in the Caribbean.

There are some 20,000 tank cars moving L.P.G. Tank-truck movements, which account for about half of all L.P.G. hauls, continue to increase.

Domestic and motor fuel . . . One of the fast-growing markets is for motor fuel, according to Phillips.

L.P.G. Figures Spiral to New Heights

(Thousands of gallons)

Year	Total sales	Domestic and motor fuel*	Industrial misc.†	Gas mfg.	Chemical mfg.	Rubber components
1922	233	Sale of liquefied petroleum gas confined primarily to bottled gas business prior to 1928				
1923	277					
1924	376					
1925	404					
1926	465					
1927	1,091					
1928	4,523	2,600	400	1,500		
1929	9,931	5,900	1,500	2,500		
1930	18,017	11,800	2,200	4,000		
1931	28,770	15,295	7,172	6,303		
1932	34,115	16,244	8,167	9,703		
1933	38,931	16,626	13,987	8,318		
1934	56,427	17,681	32,448	6,298		
1935	76,855	21,380	47,894	7,581		
1936	106,652	30,014	67,267	9,371		
1937	141,400	40,823	62,610	11,175	26,792	
1938	165,201	57,832	62,694	12,386	32,299	
1939	233,580	87,530	93,723	15,435	26,892	
1940	313,456	134,018	124,482	20,285	34,671	
1941	462,852	220,722	172,669	25,255	44,206	
1942	585,440	303,857	197,179	31,366	53,038	
1943	675,233	344,962	237,396	37,519	55,356	
1944	1,060,156	445,617	254,590	45,879	151,985	162,085
1945	1,276,766	533,262	256,577	53,849	224,291	208,787
1946	1,704,262	758,466	253,745	86,660	311,499	293,892
1947	2,209,797	1,150,538	274,125	169,332	414,267	201,535
1948	2,736,801	1,473,289	275,883	237,638	524,350	225,641
1949	2,836,599	1,627,550	247,103	239,210	544,886	177,850
1950	3,482,567	2,022,464	355,456	251,694	624,468	228,485
1951	4,227,275	2,456,804	269,408	281,692	844,507	374,864
1952	4,477,379	2,636,736	338,959	259,697	870,990	370,997
1953	4,932,009	2,977,418	374,233	222,430	967,427	390,501
1954	5,125,533	3,174,012	401,615	191,932	1,050,239	307,735
1955	6,006,000	3,661,000	431,000	171,000	1,262,000	481,000

*Household use plus other requirements by these customers such as irrigation pumping, tractor fuel, flame weeding, chicken brooding and similar uses. Included also is L.P.G. sold by domestic distributors but used for industrial purposes. Included also, in years following 1950, is L.P.G. sold direct by producers and marketers solely for fueling internal combustion engines.

†For all years prior to 1951, include L.P.G. sold for refueling internal combustion engines.

In this table total sales for all years except 1955 were obtained from U. S. Bureau of Mines reports. Distribution for the years 1931 to 1954 inclusive was obtained from the same source. All other volumes were estimated by Phillips Petroleum. The total sales volume includes all L.P.G. (propane, butane, and propane-butane mixtures) when sold as such. Until 1944 the sale of pentane when sold for any purpose other than motor fuel blending was included. Since then it has been excluded. It does not include butane when blended with heavier petroleum fractions for motor gasoline purposes. Intercompany sales transactions such as purchases of L.P.G. by one company from other companies and resold as L.P.G. have been eliminated in order to avoid duplication of sales figures.

Internal-combustion engines last year burned 671,000,000 gal. of L.P.G., 22.6 per cent more than the previous year. That's more than 11 per cent of total industry sales.

This trend, toward greater use for motor fuel, was almost nation-wide.

There are more than 250,000 L.P.G. tractors in the United States, according to the Phillips survey, and tractor conversions the first 6 months of 1955 increased 71 per cent. Carburetor sales, not counting those for tractors, rose 87 per cent.

L.P.G. tractors are outselling units which burn gasoline or diesel fuel as much as 10 to 1 in some parts of the country.

Other major motor-fuel users are trucks, buses, irrigation-pump engines, and drilling engines.

The biggest domestic market is in home heating, and this use of L.P.G. continues to spread northward. Appliance sales keep rising too.

Chemical and rubber . . . L.P.G. going into manufacture of chemicals and chemical intermediates was up 20.2 per cent over 1954.

This volume was pushed to 1,262,000,000 gal., largely by the growth of the petrochemical industry and booming industrial activity generally.

The expansion of ethylene and polyethylene capacity has resulted in greater demand for L.P.G. to supplement ethane as a base material. And this buildup, already little short of phenomenal, is on the threshold of still another boom.

New uses of L.P.G. include manufacture of glycerin and phenol from propylene, and production of nitro paraffins and its derivatives, principally from propane. Oxygenated chemicals continue to depend on propane and butane as raw materials.

Add sales for chemicals to the total for synthetic-rubber components, a chemical use anyway, and you get a volume of 1,743,000,000 gal. for last year. That's almost 30 per cent of total sales.

More and more normal butane will go into a butadiene, which with styrene provides the raw material for synthetic rubber produced in copolymer plants. Increased volumes of butylenes are being used by refiners as a cheap means to raise motor-fuel octanes. This demand is expected to grow.

Industrial and miscellaneous . . . This market had a modest 7.3 per cent gain last year to 431,000,000 gal. It lost some customers to natural gas but was buoyed above 1954 by new applications and the high level of business.

One new market is for standby fuel in uranium processing as protection against interrupted service during the winter.

Exports . . . Exports were 10 per cent higher as L.P.G. continued to catch on in France, England, Canada, Mexico, Venezuela, the Scandinavian countries, and Italy.

Here, too, the outlook is bright.

The only direction that L.P.G. men can see is up—higher production as natural gas and crude output rises, bigger sales as present markets are expanded and new ones opened, and as means are found to enter untapped markets now barred by high costs of storage and transportation.

Court to Test FPC Strength

WASHINGTON.—The Federal Power Commission's licensing of independent producers to sell gas to interstate pipelines will get its first test in the District of Columbia Court of Appeals.

The court denied motions by American Louisiana Pipe Line Co. and the FPC to dismiss an appeal by Panhandle Eastern Pipe Line Co. and the city of Memphis. The latter two want a review of the commission's grant of certificates to four producers to supply gas for the $140,000,000 Tepetate, La.-Detroit pipeline now being built by American Louisiana. Date for the hearing has not been set.

The petitioners charged they had been denied due process of law by being excluded from hearings which resulted in certificates to Superior Oil Co., Kerr-McGee Oil Industries, Inc., Stanolind Oil & Gas Co., and British-American Oil Producing Co. *(The Oil and Gas Journal, April 25, page 96).*

Gas Bill Gets New Backer

Consumer-producer group headed by former Indianapolis mayor pledges to scotch propaganda against Harris bill

WASHINGTON.—Another new group got into the fight for the Harris bill last week.

The Joint Committee of Consumers and Small Gas Producers opened offices in Washington. Its theme: "To fight with facts the irresponsible and unrealistic propaganda which is threatening to destroy the supply of natural gas."

Alex M. Clark, whose term as mayor of Indianapolis ended December 31, will head the committee. P. K. Ward, who served with him as city attorney, will be secretary-treasurer.

The group will answer "with facts" the propaganda of the recently formed Council of Local Gas Companies and other opponents of the Harris bill.

Utilities blasted . . . Clark started the committee off with a blast against the gas distributors.

"Certain big eastern utilities have amassed many, many millions of dollars from the pocketbooks of their several million natural-gas consumers by failing to give them proper rate reductions for heating their homes, cooking their meals, and operating their businesses," he charged.

The distributors have failed to pass on to the public the savings arising from the substitution of natural gas for the manufactured product, Clark asserted. But they now want "frosting" on their cake in the shape of government price-fixing at the producer end of the line, he said.

The Harris bill will protect the consumers in the only way they need it, Clark declared. It assures a plentiful supply of natural gas and gives the Federal Power Commission ample authority to prevent future price increases.

"My primary interest is to represent those whose voices have not heretofore been heard," Clark said.

"There has been formed here in Washington another committee dominated by a group of big eastern utilities who distribute gas. These utilities, enjoying monopolistic franchises, have joined in a movement to perpetuate direct government price-fixing of natural gas at the producer level.

"In this group are some companies who are charging some of the highest gas rates in the country and I intend at a later date to analyze some of these companies' operations and false claims."

Reason for committee . . . Clark said his committee was formed as a result of many suggestions that a voice be given the small producers and consumers, following his testimony before the House interstate commerce committee last June.

"My resolve to carry on this fight has been strengthened in recent weeks upon reading a series of misleading statements that, if not disproved, might become detrimental to the nation's needs for increased supplies of natural gas."

Clark warned that federal control of natural gas could be the first step toward wider dictation to industry from Washington.

"If the federal Government has the right to fix the price of gas where it comes out of the ground, then it can be assumed that the federal Government has the right to fix prices on anything and everything else that comes out of the ground, including grain, vegetables, coal, lumber and minerals," he said.

"If we are going to continue to protect our natural-gas supplies then we must end the present kind of price-fixing. If we are not, there is an awful lot of woe ahead for natural-gas consumers, and I mean all the way from the homeowner to the biggest industrialist."

Imports Level Off—Still High

IMPORTS and exports changed very little in October compared with September.

Imports decreased by 1.1 per cent, and exports gained only 0.9 per cent. But, comparisons with the same month of 1954 show wide variations in the trends. October imports gained 17.7 per cent over a year ago while exports were up only 2.8 per cent.

Total imports for October averaged 1,199,000 bbl. daily, according to reports compiled by the Census Bureau of the Department of Commerce. This total included 814,000 bbl. daily of crude and 385,000 bbl. daily of products.

Product imports averaged 18,000 bbl. daily less than for October last year, but crude increased 198,500 bbl. daily.

This over-all gain of 198,500 bbl. daily is made up from: A gain of 74,600 bbl. daily for the Middle East, 97,000 bbl. daily more from Venezuela and a gain of 53,900 bbl. daily for Canada; combined with decreases of 11,300 bbl. daily for other Latin American areas and 16,600 bbl. daily for the Far East.

Imports of residual fuel averaged 339,400 bbl. daily in October compared with 340,200 during October of last year. The October average was less than for any of the months this year through June.

The failure of resid receipts to follow the normal seasonal trend indicates the near shortage of heavy fuel in world markets.

Crude and product exports averaged 328,000 bbl. daily in October compared with 325,000 bbl. daily in September and 319,000 bbl. daily a year ago. Decreases from September averages were reported for kerosine, residual, and lubes. Gains were in crude, gasoline, distillate, and other products.

IMPORTS INTO CONTINENTAL U. S.
(Thousands of barrels)

Crude—	Oct. 1955	Sept. 1955	Oct. 1954
Mexico	244	803	581
Colombia	746	491	704
Venezuela	12,989	11,907	9,952
Peru			126
Ecuador	72	72	
Trinidad			
Kuwait	4,605	4,397	2,981
Saudi Arabia	2,264	2,374	2,117
Neutral Zone	165		622
Iraq	821	652	
Iran	402	395	
Qatar	175	858	399
Canada	1,744	1,846	73
Far East	996	968	1,510
Total crude	25,223	24,763	19,065
Daily average	814	826	615
Products—			
Residual fuel	10,521	9,126	10,547
Other products	1,405	2,463	1,936
Total products	11,926	11,589	12,483
Daily average	385	386	403
Total all oils	37,149	36,352	31,548
Daily average	1,199	1,212	1,018

EXPORTS*

	Oct. 1955	Sept. 1955	Oct. 1954
Crude	871	832	1,485
Gasoline	2,663	2,269	2,529
Kerosine	93	144	187
Distillate fuel	2,279	2,179	2,178
Residual fuel	1,913	2,241	1,297
Lube oils	1,071	1,148	1,188
Other products	1,263	938	1,015
Total all oils	10,153	9,751	9,879
Daily average	328	325	319

*Excludes shipments to territories.

Onassis stuck for $7 million . . .

. . . Ship-Sales Scandal Settled

WASHINGTON. — The Government practically completed its clean-up of the postwar surplus ship-sales scandal last week.

Attorney General Brownell announced that the A. S. Onassis interests agreed to pay $7,000,000 to settle charges that they had illegally acquired 13 tankers and 10 other ships from the old Maritime Commission between 1948 and 1951.

In addition, Brownell said, the Onassis companies—U. S. Petroleum Carriers, Inc.; Victory Carriers, Inc.; Western Tankers, Inc.; and Trafalgar Steamship Corp.—will be reorganized to insure American ownership and control.

The companies will be permitted to keep the vessels. This will carry out a basic national-defense policy by keeping them in ready condition in the event of an emergency, Brownell said. It also will maintain employment and, no less important, save the Government considerable money. He estimated it would cost $30,000 a year to lay up each vessel and $90,000 to reactivate it, if the ships were taken back by the Government.

The companies, however, will have to pay some $500,000 to make up arrears in principal and interest on outstanding Maritime Administration mortgages and will remain obligated for a mortgage balance of $5,500,000. There is also some $8,500,000 in private mortgages held by the First National City Bank as trustee for the Metropolitan Life Insurance Co.

Background . . . The ship-sales scandal was opened in April 1951 by a Senate committee.

The following year the committee held open hearings, filing a recommendation that the Government take prompt action. In a series of forfeiture cases the Justice Department sought the recovery of 46 vessels.

The Onassis interests were among several groups which secured surplus ships in violation of the law against ownership of U. S. flag ships by aliens.

Over the past 15 months the department has settled cases against affiliates of United Tanker Corp., which were financed almost entirely by Chinese investors; the Stavros Niarchos interests; and corporations controlled by Manuel E. Kulukundis.

Total recoveries from these cases amounted to some $15,000,000.

Court orders gas flow . . .

. . . Minot Victory Ends Deadlock

MINOT, N. D.—A sudden court order has cleared the way for Minot to get natural-gas service by mid-January. Crews of Montana-Dakota Utilities Co. are busy converting the distribution system to handle natural gas.

District Judge A. J. Gronna granted a City of Minot petition demanding the gas service and permitted the utility to tie its new transmission line into the city distribution system.

Montana-Dakota had been stymied from serving Minot when the North Dakota Public Service Commission imposed heavy conditions on the utility before allowing it to operate a new pipeline from Tioga (*The Oil and Gas Journal, December 5, page 88*).

City officials in their petition before Judge Gronna claimed the natural gas was needed to relieve a shortage of propane here. They also argued gas which could be sent through the new pipeline was being flared near Tioga and that the utility does not need a certificate to build or operate the line.

The judge's decision does not end the utility dispute with the public service commission, however.

A hearing is scheduled late this week in Ward County District Court on an appeal motion filed by the utility against the commission order. Another hearing is set in Bismarck for January 16 on a writ of prohibition asked by the utility to prevent the commission from summoning company officials to a contempt hearing.

Pipeline deal approved . . . Meanwhile, the Federal Power Commission in Washington approved Montana-Dakota's plan to acquire Montana-Wyoming Gas Pipe Line Co. in an $8-million deal.

Montana-Dakota has operated the facilities under lease agreement for several years. The Montana-Wyoming property consists of a 340-mile, 12-in. pipeline from Worland gas field in Washakie County, Wyoming, to Montana-Dakota's Cabin Creek compressor station near Baker, Mont.

Montana-Dakota will issue 241,577 shares of common stock to Montana-Wyoming and assume its $4,875,000 first mortgage pipeline bonds. Book value of Montana-Wyoming facilities is $8,191,305.

'55 Strikes Fizzle

New California fields may be poorest found in years

LOS ANGELES.—Caliber of new oil fields discovered in California during the first 11 months of 1955 may have been the lowest of recent years.

This is the conclusion drawn from their performance on December 1.

Figures compiled by the Conservation Committee of California Oil Producers credited nine wildcats as new field discoveries. This compares with 10 during all of 1954. But while the totals were about the same, output of these one-well fields was disappointingly low—a total of only 530 bbl. daily.

In finding this new production about 154 unsuccessful new field wildcats were drilled, or an average of 15 dry holes for each new find. Last year the ratio was one strike for each 27 attempts. Examination of this year's crop, however, indicates that only two or three of the new fields are producing at rates of any consequence. Several may be noncommercial.

Twenty-eight new pool discoveries were made in old fields during the first 11 months, as compared with 22 in the like period of 1954. Production from the 266 wells completed in these finds was estimated by the Conservation Committee at 14,875 bbl. daily. New pools discovered the previous year were yielding almost 25,000 bbl. daily at the close of last year.

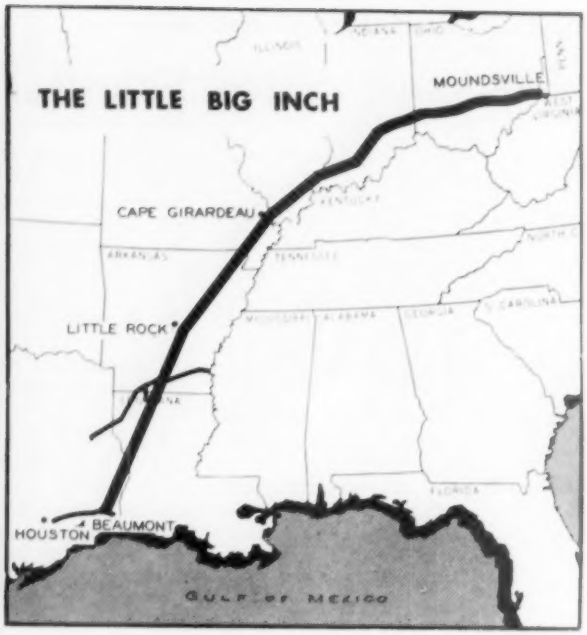
Wildcat Hits Oil In L.A.

LOS ANGELES.—An oil producer has been completed in the Boyle Heights area of Los Angeles only 4 miles east of the city hall.

The wildcat, Richfield Oil Corp.'s 1 Boyle Industrial, flowed at the rate of 170 bbl. daily of 26°-gravity oil through 12/64-in. choke. Production was from sands at 3,130-3,492 ft.

Following completion, the discovery was shut in pending a pipeline outlet. City ordinances prevent crude from being trucked out.

Richfield has a 500-acre drilling block comprised of 1,500 leases. The company drilled two unsuccessful tests to 5,900 ft. in the area in 1946 and 1948.



Products from this Beaumont tank farm . . .. . . will travel this route for Texas Eastern.

Switch Time Nears For Little Big Inch

Robert J. Enright

SHREVEPORT.—Conversion of the Little Big Inch from natural gas to the world's biggest products pipeline is picking up steam.

Already about 50,000,000 cu. ft. of gas daily which was flowing through the Little Big Inch a few weeks ago has been shifted to the new 30-in. gas trunk running northeast from Beaumont, Tex.

Texas Eastern Transmission Corp., which bought the war-emergency lines (Big Inch and Little Big Inch) from the Government in 1947, has its conversion time table geared to begin pumping products through the 20-in. by June 1.

The line will carry a complete range of products from the Baytown, Tex., Beaumont, and El Dorado, Ark., refining areas to Cape Girardeau, Mo., and Moundsville, W. Va.

The original Little Big Inch from Beaumont to Linden, N. J., built in 1943 and 1944, is 1,479 miles long. The section of this system which is now being reconverted is 1,168 miles long. Initial estimated operating capacity will be 185,000 bbl. per day.

A major feature for big mainline pumping will be use of semioutdoor, single-unit, remote-controlled stations. These will be attended only by a caretaker.

Pump-station conversion . . . Construction of new gas capacity to take over deliveries of the Little Big Inch is virtually complete. Other phases of the conversion are proceeding on schedule, too.

Texas Eastern has ordered 45,000 tons of various diameter pipe for installation at pump stations, product terminals, tank farms, and for construction of some lateral lines. The laterals will be 4-in. to 12-in.

The company is taking delivery of 5,000 tons of the pipe in December. The order will be completed in April 1956.

All major equipment for the products line has been ordered. This includes pumps, meters, and smaller items.

An order for 22 mainline pumps has been placed with United Centrifugal Pumps. These will be for 2,000-hp. electric-centrifugal units. There will be one unit at each station at the original sites—where products pump stations were located when the line was first built by War Emergency Pipeline Co. for the Government.

Shipment of pumps is scheduled to begin March 2 and the last ones will arrive by May 18. Work on pump-station sites will begin in February.

The company is not buying any motors or electrical switchgear. The motors first used on the products line, then relocated at compressor stations for gas service, will again be redistributed to power the products pumps. They will be force-ventilated but will not require rewinding or other work.

Switchgear will be broken out at compressor stations, shipped to one or two central points for revision to conform to products line automation, and reinstalled at the pump stations.

Tank repair and expansion . . . When Texas Eastern bought the Little Big Inch and converted it to gas service, it leased its 1,100,000-bbl. tank farm at Beaumont to Shell Oil Co.

It has canceled this lease and Shell is vacating the tank farm as of December 31. There are 20 big 55,000-bbl. tanks at the farm. Texas Eastern is negotiating with contractors for remedial work on 12 of them. Work will begin on some of these tanks immediately, and be completed on all of them in May.

In addition, Texas Eastern will build 56 new tanks totaling about 4,000,000 bbl. elsewhere up and down the system. The company has contracted with Graver Tank & Manufacturing Co., Chicago Bridge & Iron Co., and General American Transportation Corp. to manufacture and erect the new tankage. All of these tanks are slated for completion by the first of June.

The new tankage, plus that at Beaumont, and that on the products system formerly owned by Triangle Pipeline

Co., which Texas Eastern absorbed by merger recently, will bring total tank capacity of the Little Big Inch system to nearly 7,000,000 bbl. Triangle had about 1,692,000 bbl. at El Dorado, Ark., Arkansas City, Ark., and Carthage, Tex.

Texas Eastern has taken an option on a site for a tank farm at Cape Girardeau, Mo., and is negotiating for more tank-farm land at other locations.

Communications . . . The company also has completed planning for communications controls on the products line and has contracted to lease a new system developed by Bell Laboratories of American Telephone & Telegraph.

The system will have a teletype dispatch circuit and a control circuit. The former is a loop circuit with teletype units at all pump stations and control points.

The control circuit will have several major control points along the line, each able to control all necessary functions at downstream stations up to but not including the next control point.

The contract calls for the system to be ready to go into operation by June 1. A. T. & T. will install an interim teletype-control system, however, which the pipeline will be able to use by March 1.

Another big job . . . In April or May, Texas Eastern will pump all gas out of the Little Big Inch. As soon as this is done, work gangs will start on another big job.

They will have to tear out 125 cross lines connecting the Little Big Inch with the larger 24-in. Big Inch.

When this is accomplished, the world's biggest long line products carrier will be practically ready to go. The company will clean and pressure test the line before operations are begun. Engineers expect no difficulties here since the line has operated at pressures in gas service that are similar to what will be called for in products service.

Products will begin to flow into the line from Baytown, Beaumont, and El Dorado for line-fill — which, incidentally, will take a whopping 2,200,000 bbl. from Baytown to Moundsville. As each section is filled, it will be tested via a pressure squeeze.

Replacing gas capacity . . . Texas Eastern has almost completed new gas facilities to take over the 200,000,000 cu. ft. daily load of the Little Big Inch.

The company laid 377 miles of 30-in. from Beaumont to Kosciusko, Miss., to connect with a 30-in. built in 1952 from Kosciusko to Connellsville, Pa. All pipe laying on the $70,883,000 extension was substantially complete in October, and hydrostatic testing followed *(The Oil and Gas Journal, November 7, page 76)*.

Construction of eight new compressor stations and of compressor additions at five existing stations is being pushed hard. Texas Eastern will more than double compressor horsepower now in place on the line. This comes now to 53,800 hp.

The company is adding 31,020 hp. to existing stations and installing 91,400 hp. in compressors at the new ones—a total hike of 122,420 hp.

Of this amount, 19 compressor units totaling 19,800 hp. will come from present compressor stations on the Little Big Inch. These units already have been taken out of service on the 20-in. and either have been or are being installed on the new 30-in. This work will be completed by mid-January. The remaining compressor units still on the Little Big Inch will be retired from service.

Texas Eastern already has completed a 5,000-hp. addition to the former 12,500-hp. Kosciusko gas-engine reciprocating station and a 3,520-hp. boost at the Danville, Ky., station which formerly had 8,800 hp.

Doubling of the present 7,500 hp. at electric-motor-driven centrifugal stations at Barton, Ala., Gladeville, Tenn., and Wheelersburg, Ohio, will be completed by the end of the year.

Construction of five of the new stations will be completed by January 15. These are gas-engine reciprocating stations at Booth, Tex. (2,200 hp.), Vidor, Tex. (5,000 hp.), and Holbrook, Pa. (8,800 hp.), and gas-turbine centrifugals at Owingsville, Ky. (15,200 hp.), and Athens, Ohio (15,200 hp.).

The company is temporarily stymied on construction of the three remaining new stations at Egypt, Miss., Mt. Pleasant, Tenn., and Tompkinsville, Ky. All of these are 15,000-hp. electric-centrifugal installations. Delivery of the compressors for these stations has been delayed because the supplier has been strikebound.

Deep Test Reams Slowly Ahead

PORT SULPHUR, La.—Richardson & Bass is reaming carefully ahead in the world's deepest well.

While the well was being brought under control after a kick 3 weeks ago, shale sections caved and sloughed off badly. As a result, reaming must be slow to keep any fresh caving from sticking the pipe. Moreover, there is still a danger of drilling into high-pressure pockets under bridges in the hole.

Late last week, the 1 LL&E-Humble "L" had reamed to 20,718 ft. and the crew was pulling pipe to change bits. The bottom of the hole is at 22,559 ft. —deepest penetration of any hole ever drilled.

Much shale has been circulated out of the hole since pipe was lowered into the open hole under the 7-in. liner at 19,752 ft. For that reason, reaming is being held back to about one joint each hour. The drill string has a 6-in. bit and only one drill collar on bottom.

Small quantities of oil and gas are still being circulated out of the hole as reaming progresses. There has also been an increase in salt content of the mud.

Present plans call for no more drilling—the hole is to be bottomed at its present total depth *(The Oil and Gas Journal, December 26, page 130)*. As soon as reaming has progressed far enough, a 5-in. liner will be run to case off the open hole. There have been several promising zones below 20,000 ft., and prospect for a successful oil completion look good.

National Tube Changes Billing System

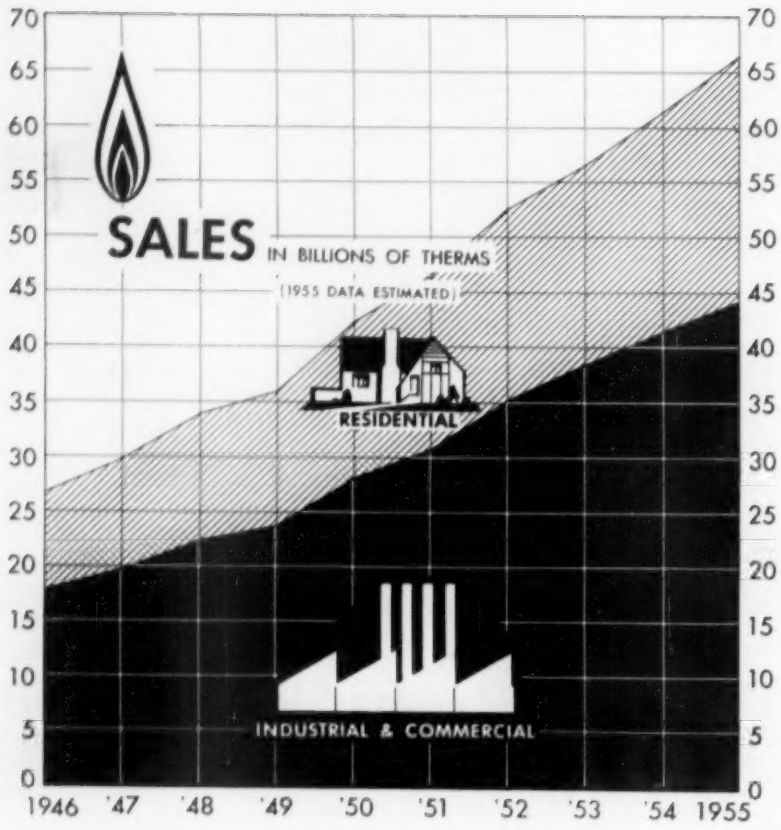
TULSA.—U. S. Steel's National Tube Division has taken pricing of standard and line pipe out of the hands of distributors.

The action is designed to eliminate "chaos in quotations and pricing." In other words, it's a crackdown on black marketing. Oil-country goods are not involved in the change.

Distributors previously took orders and billed customers direct. They received a 5 per cent commission. Some were reported to be selling below the mill price. They might quote the user as much as 5 per cent off, cutting their margin down to the 2 per cent cash discount.

Distributors who have signed an agreement to abide by the new procedure may still solicit business. They still get the 5 per cent commission. But now National Tube bills the customer. Private deals between customer and distributor are out.

Other pipe suppliers are watching the situation with interest. Some are considering a similar move. So far no one has followed National Tube's lead.



Gas Outlook Bright

Another billion-dollar construction year seen by A.G.A. for 1956; long-range picture also viewed with optimism

NEW YORK.—The gas industry has just closed out one of its most successful years. Prospects are for an even busier and more profitable one in 1956.

Gas utility and pipeline companies spent about $1,385,000,000 for new construction and expanding facilities during 1955. The industry expects to spend $1,205,000,000 for such work this year.

The American Gas Association reports more than $4.3 billion will be spent on construction by the industry in the 4 years from 1955 through 1958. The industry now has nearly $16 billion in gross assets and is on its way to becoming a $20-billion industry.

This vast building investment is paying off too in ever-increasing customers, sales, revenues, and reserves.

Pipelining booms . . . Big transmission lines keep fanning out over the country. Soon every state except two will be receiving natural gas, A.G.A. says.

During 1955 the Federal Power Commission authorized construction of about 4,500 miles of new natural-gas transmission lines. More than 3,000 miles actually were laid. The remaining 1,500 miles are under way.

In addition more than 22,000 miles of natural-gas distribution and storage pipeline, not requiring FPC approval, were constructed during the year.

This 1955 expansion brings the total of natural-gas pipelines of all categories to 445,000 miles. An additional 50,000 miles of pipeline carry manufactured and mixed gas.

Two gigantic pipeline projects made news in 1955. FPC gave full certification for American-Louisiana Pipeline Co.'s 1,289-mile line from Texas to Michigan and for Pacific Northwest Co.'s 1,466-mile line from the San Juan basin to the northwestern states.

Position of Pacific Northwest was strengthened by the decision of the FPC to authorize gas imports from Canada. Westcoast Transmission Co. will build a line from the Peace River fields to bring the additional supplies to Pacific Northwest.

As the year ended, the FPC had before it a request to authorize imports of gas from Mexico also. Texas Eastern Transmission Co. has contracted for the Mexican gas and plans a $150-million program to expand its system to move the fuel to eastern markets.

Key role of storage . . . The industry put increased emphasis on underground storage in 1955. It became an increasingly important factor in stabilizing the gas load.

At the start of 1955 there were 172 underground storage pools located in 17 states. These active pools have an ultimate capacity of 1,859 billion cubic feet. In addition 12 pools were under construction, adding 200 billion cubic feet of storage space to the total.

The industry spent nearly $75 million on building new underground facilities in 1955. It expects to lay out $50 million more in 1956, and a total of $187 million in the years 1955 through 1958.

The industry also was in a strong position in proved recoverable reserves. At the beginning of 1955 reserves had reached a new high—211.7 trillion cubic feet. This was an increase of about 263 billion cubic feet during 1954 and was realized in spite of peak production during the year of 9.4 trillion cubic feet.

How's the market? . . . The list of gas customers is getting higher.

Natural-Gas Growth In 1955

	1955	1954	Per cent increase
Customers (average):			
Residential	21,210,000	19,719,600	7.6
Commercial	1,705,000	1,572,400	8.4
Industrial	92,000	81,600	12.7
Other	28,000	24,800	
Total	23,035,000	21,398,400	7.6
Sales (thousands of therms):			
Residential	19,908,700	17,830,300	11.7
Commercial	5,492,800	4,909,100	11.9
Industrial	34,574,800	32,407,100	6.7
Other	2,931,800	2,867,600	
Total	62,908,100	58,014,100	8.4

Nearly 2 million more people were using natural gas in 1955 than the year before. This sent the total customer figure to 24 million, a gain of 8.4 per cent for a year.

Natural-gas sales achieved a new high of 62.9 trillion therms, also a gain of 8.4 per cent. Revenues hit a peak of 2,995,000,000, up 16.2 per cent.

New markets . . . A.G.A. statisticians see a great potential market still existing by expansion of service and development of new equipment using natural gas.

They anticipate that space heating requirements alone in 1957 should be 53 per cent ahead of 1954 and overall sales by 1957 could total about 75 billion therms.

This growth will require not only big capital investment but also a vast supply of materials. The gas industry will require 6.2 million tons of steel pipe for the 1955-58 period. About 2.2 million tons were used in 1955 alone. In the next 3 years an additional 3 million tons will be needed in the form of 16-in. or larger pipe, 199,000 tons of steel in other forms, and 815,000 tons of cast iron.

Expansion of natural-gas use is reflected in sales records made by appliances. New records were set for gas ranges, water heaters, central heating units, refrigerators, and automatic clothes dryers.

High hopes were held out for two newer appliances—air-conditioning and incinerator units. They are the object of intensive research effort.

Transok Line Completed

TULSA.—Transok Pipe Line Co. has completed its 140-mile, 24-in. natural-gas line from near Lindsay, Okla., to Public Service Co.'s Tulsa power plant.

Pipe Line Service Co. of Seminole, Okla., laid the line to bring gas from the Northwest Purdy, West Lindsay, and Bradley area pools of southern Oklahoma.

Public Service has a contract to buy more than a trillion cubic feet of gas over a 25-year period direct from Phillips Petroleum Co. and Magnolia Petroleum Co. *(The Oil and Gas Journal, May 16, page 21)*. The utility is receiving 10,000 M.c.f. daily. Deliveries will be as high as 20,000 M.c.f. daily during the summer power-load peak. The price under the unique supply arrangement, bypassing the transmission industry, starts at 12 cents a M.c.f. It goes up to 18 cents in a few years and may be changed later to conform with the going field price.

WATCHING WASHINGTON

Bertram F. Linz

Shelf Decision Looms

New areas of the Continental Shelf may be opened to oil and gas leasing this year.

The Interior Department is awaiting only the ruling of the Supreme Court defining California's seaward boundary before mapping the areas that will fall into the "outer" Continental Shelf.

The court appointed a master to define the boundary following its 1947 "tidelands" decision. He has made his report. For the most part it holds that bays and channels claimed by California do not come within the 3-mile limit.

The extent of the area that will fall to the federal Government cannot be estimated now. It runs from Point Concepcion, north of Santa Barbara, to the Mexican border. At least a couple of big oil companies already have expressed interest in getting leases as soon as the state line is fixed.

Across the continent, the department is making studies of the outer Continental Shelf off the west coast of Florida. At present, the study is limited to the area beyond the 3-league limit claimed by the state. Whether the line will fall closer inshore eventually will depend upon the success of the Justice Department in challenging Louisiana's boundary claims.

If the Supreme Court rules that Louisiana is entitled only to a 3-mile coastal area, the department is expected to bring similar suits against Texas and Florida.

Equipment Outlook Tight

The oil industry is planning to drill even more wells this year than the estimated 57,000 drilled in 1955, according to reports reaching the Commerce Department.

That means continued high production of oil-field equipment through at least the first half of the year, the department predicts in a year-end review.

Equipment production now is running about 7 per cent above 1 year ago. Whether it can be increased further apparently will depend upon the availability of steel and copper. Both are very tight, with little indication that steel supplies will loosen up in the near future.

The first half of 1956 may see the highest output in history. Order books reportedly are solid through the first 6 months. Most products will remain in short supply. Tubular goods is one of the lines most severely affected.

Nickel, too, will be short. This will limit the output of nickel-bearing alloys, including stainless steel, below the growing demand.

The department expects copper to continue short over the next 3 months. But it is expected that supply will approach demand in the second quarter, when new production comes in.

The current tight situation in rubber is expected to ease somewhat when the synthetic plant at Institute, W. Va., comes into private operation and expansions planned at other plants are completed.

Political Feathers Ruffled

Washington's latest oil row is strictly for the birds.

It started last month when the Interior Department opened its wildlife refuges to oil and gas leasing. That action was taken only after consultation with the department's advisory committee on conservation, of which Dr. Ira N. Gabrielson of the Wild-Life Management Institute is a member.

The department thought it was all set when the committee unanimously agreed that the new regulations would protect the birds. But just before Christmas, Gabrielson reversed his field. The birds, he said, are in danger of losing their hideouts. The refuges should be kept closed, except where the President finds development necessary.

That gave Sen. Wayne Morse of Oregon a chance to throw a heavy feather at his fellow-stater, Secretary Douglas McKay. Morse called for a congressional probe of the department's willingness to sacrifice the birds "whenever a piece of the people's resources is coveted by monopoly and big business."

McKay was quick with a comeback. This sudden fear for the safety of the birds and the charge the department is giving its oil away, he said, are based on "political rather than conservation" aims.

All the charges so far have been tossed by politicians and conservationists. Nothing noteworthy has been heard from the birds.

Octanes Unchanged

But averages still above last year, Ethyl reports

NEW YORK.—The national averages on octanes of premium and regular gasoline remained essentially unchanged through December, according to the monthly survey conducted by Ethyl Corp.

Weighted average for premium grade stood at 96.0 research octane number, unchanged from November, and 1.8 numbers above the average of a year ago.

Regular grade increased 0.1 octane number since November to reach 88.9, which is 1.6 numbers above that of a year ago.

Average tetraethyl lead contents declined since November, from 2.52 to 2.48 ml. per gallon for premium and from 2.27 to 2.22 for regular.

The highest arithmetic average for any city in the U. S. was recorded by Little Rock which jumped to 97.5 research octane. Pittsburgh, which last month showed highest octane averaged for both grades, maintained the lead in regular, with 91.6.

Premium distribution by cities follows:

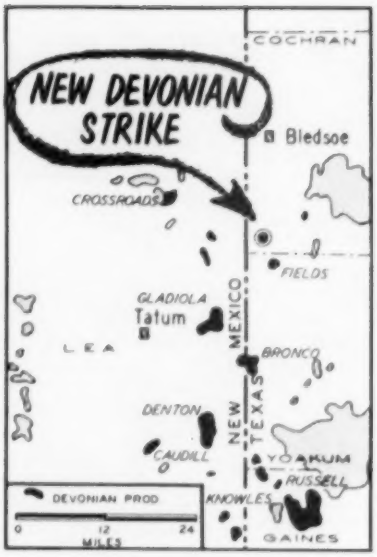
PREMIUM GRADE

	Dec. 1955	Nov. 1955	Dec. 1954
90.8-90.9	0	1	0
91.0-91.9	1	0	6
92.0-92.9	1	1	11
93.0-93.9	1	3	7
94.0-94.9	12	9	18
95.0-95.9	11	14	10
96.0-96.9	17	19	1
97.0-97.5	10	6	0
	53	53	53

The distribution of octanes in regular grade shows two peaks. The 15 cities in the 86.0-86.9 octane range are mainly located in the Mid-Continent, Rocky Mountain and West Coast. The 31 cities showing 88.0 octane and higher are with few exceptions, located east of the Mississippi River and the Gulf Coast, including North Texas, Louisiana, and Arkansas. The breakdown on cities in the regular grade category follows:

REGULAR GRADE

	Dec. 1955	Nov. 1955	Dec. 1954
82.0-82.9	1	1	3
83.0-83.9	1	1	4
84.0-84.9	1	0	13
85.0-85.9	1	5	5
86.0-86.9	15	13	3
87.0-87.9	3	4	12
88.0-88.9	11	9	4
89.0-89.9	8	10	5
90.0-90.9	10	6	4
91.0-91.9	2	4	0
	53	53	53



New Devonian Trend

Cochran County wildcat may prove up new area

LUBBOCK. — Significant Devonian production has been opened in southwestern Cochran County of far West Texas.

The wildcat is the 1 Stella Thompson "B" of Jake L. Hamon and Texas Pacific Coal & Oil Co. Location is 12 miles northeast of the town of Bronco and 4 miles northwest of nearest Devonian production in the Fields area in Yoakum County. It also is east of similar wells in Lea County, New Mexico.

The well flowed oil on a drill stem test and operators have begun running 5½-in. oil string to total depth of 11,902 ft.

Testing was from 11,826-11,902 ft. with ⅝-in. choke and 1,020-ft. water blanket. With the tool open 2 hours and 45 minutes, gas surfaced in 65 minutes and oil-cut mud in an hour and 50 minutes.

Flow was estimated at 30 bbl. of mud-cut oil per hour with no water. The well then was shut in 30 minutes and unloaded an unestimated amount of oil. Flowing pressure ranged from 1,460-4,090 psi. and 30-minute shut-in pressure was 4,625 psi.

Prior to the drill-stem test, the well cored from 11,877-11,902 ft. and recovered 5½ ft. of black shale and ½ ft. of vuggy dolomite.

Lease Hearing Scheduled

SANTA BARBARA, Calif. — The state Lands Commission will meet here January 11 to hear any objections to leasing a 2,500-acre area offshore from the old Summerland oil field.

The parcel skirts the shore for about 1½ miles and extends seaward 3 miles. Saint Anthony Oil Corp. asked 3 months ago that the tract be offered for competitive bidding. The application is the first processed under the new tidelands leasing statutes which became effective in September.

Adena Is Unitized

Action may raise primary recovery 10,000,000 bbl.

DENVER.—Unitization of Colorado's Adena field, largest in the Denver-Julesburg basin, became effective January 1 with approval of the state Oil and Gas Conservation Commission.

The commission also made permanent previous orders establishing 40-acre drilling and spacing units for "J" sand oil wells and 160-acre units for gas wells. In addition, maximum "J" sand production from any one well was limited to 125 bbl. of oil daily or 150,000 cu. ft. of gas, whichever is produced first. Flaring of gas is prohibited in the field, located in Morgan County.

Unitization of Colorado's second-largest oil field was termed the "biggest step" ever taken in the state's oil and gas history by H. C. Bretschneider, acting chairman of the commission. Only the prolific Rangely field in northwestern Colorado is ranked ahead of Adena.

The unitization is the first in Colorado under the state commission. Several smaller fields have been unitized under federal law.

The Adena unit governs the operation of 179 producing wells located on 11,175 acres. It was agreed to by 90 companies and individuals with interests in the field. Pure Oil Co. is the unit operator, controlling one-third of the field's 14,000-bbl. daily oil production.

L. A. Ogden, Tulsa, a Pure Oil official, was designated unit engineering chairman.

Petroleum, Inc., is the only major operator whose lands are not committed to the "J" sand unit. The firm remained outside the unit on grounds its present oil production, 11.7 per cent of the field's output, would be cut to about 8 per cent under the agreement.

Primary recovery under competitive operation is estimated at 40,750,000 bbl., including 9,000,000 bbl. produced since the field was discovered in 1953. Unit operation will add 10,000,000 bbl. to primary recovery, and engineers figure an additional 17,000,000 bbl. could be produced through water flooding.

The *Beeline* Way to Better Production

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second St., Tulsa, Okla.

There are easier jobs than choosing a bottom-hole pump, but we've done our level best to make it simple. How? By offering pumps with *all* the features – every last one – that production men demand. These are the Bethlehem Beeline models, the bottom-hole pumps for every type of installation.

Here are just a few of the points that demonstrate their sound engineering:

Hardened cast-iron liners, chrome-plated plungers, double valves, armored cages, Superloy balls and seats; Simplex, three-cup, or API hold-downs; Reed and tap-type standing valve pullers. Optional features include Endurall balls and seats, hardened barrel tubes, chromium-plated barrel tubes, Reliance sectional plungers, and Endurall cages and fittings for very corrosive conditions.

Beeline sectional-liner, rod full-barrel, and three-tube pumps can be made up quickly in any length desired. They are expertly serviced in the field by Bethlehem's many pump shops, which are located in all the major production centers. At each of these well-equipped shops, a full stock of parts as well as mechanical service is always available.

Check with our nearest office or store for information. We'll be glad to give you complete details of Beeline pumps, and of Bethlehem pumping units and sucker rods.

World Production Soars

Record 7,181,300 bbl. daily recorded in non-communist foreign areas; "Big 3" exporting nations set the pace

CRUDE-OIL output in free-world countries outside the United States passed the 7,000,000-bbl.-daily level for the first time in October.

The all-time high of 7,181,300 bbl. daily was largely due to stepped-up production in the three leading crude exporting countries.

Output in Venezuela reached a record 2,215,400 bbl. daily, up 82,000 bbl. daily from the 10-month average. Kuwait production rose 110,500 bbl. daily, or 10.9 per cent over September, to 1,127,000 bbl. daily. Saudi Arabian output exceeded the million-barrel-daily mark for the first time since March, with an average of 1,002,400 bbl. daily. This figure brought the 10-month average to 951,100 bbl. daily, which is 5,600 bbl. daily under the average for the same time in 1954.

In the United States, the seasonal increase in demand brought production to 6,831,000 bbl. daily, up an even 100,000 bbl. daily over the preceding month, and the highest since April. Canadian production rose to 399,000 bbl. daily, up 36,000 bbl. daily, or 9.9 per cent.

Joins select group . . . On October 20, Kirkuk field in North Central Iraq produced its 150 millionth ton of crude (1,140,000,000 bbl.).

It was the second field in the Middle East, and the fifth in the world to achieve this cumulative total. Operated by Iraq Petroleum Co., Ltd., Kirkuk produces 500,000 bbl. daily.

The first Kirkuk well was brought in on October 14, 1927. At present, there are 43 flowing wells. Most of the output is transported through the I.P.C. pipeline system to the Mediterranean Coast for export.

In Egypt, the newly developed International Egyptian Oil Co. in southwest Sinai Peninsula produced 2,800 bbl. daily, up 600 bbl. daily, in their second month of commercial production. Belayim field averaged 2,200 bbl. daily and Feiran 600 bbl. daily.

Swiss, Belgian, and Italian interests control International Egyptian. Southern California Petroleum Corp. operates the fields and has a minority interest. The balance of Egypt's 36,600 bbl. daily production was accounted for by Anglo-Egyptian Oilfields, Ltd., which operates five fields. The company is jointly owned by Royal Dutch-Shell and Socony Mobil Oil Co., Inc.

Austria drops . . . Production in Austria averaged 68,500 bbl. daily.

This is a decrease of 700 bbl. daily from September, and 1,500 bbl. daily under the output in August when the Russians returned the fields. The October decline was caused by a slight drop in output from Aderklaa and Gaiselberg fields which together produced about 4,000 bbl. daily. The bulk of Austrian output comes from the Matzen-Auersthal-Bockfliеb area which produced 54,700 bbl. daily.

At the same time crude output dipped in Austria, natural-gas output increased to 9.1 million cubic feet daily from 8.1 million cubic feet daily the preceding month. Erdgasgesellschaft field produces about 56 per cent of the gas.

TREND OVER THE LAST YEAR

1954—	Western Hemisphere less U. S.	Middle East	Total non-Communist foreign
October	2,725.5	2,891.2	6,120.2
November	2,856.5	2,844.6	6,193.6
December	2,975.7	3,001.8	6,453.3
1955—			
January	3,001.5	2,950.1	6,442.5
February	3,050.4	3,109.3	6,653.8
March	3,036.0	3,247.9	6,775.8
April	2,981.6	3,327.6	6,805.9
May	2,932.1	3,287.4	6,718.8
June	3,019.7	3,201.6	6,720.9
July	3,092.7	3,275.8	6,872.1
August	3,140.4	3,243.0	6,978.2
September	3,130.9	3,256.9	6,990.7
October	3,203.4	3,374.2	7,181.3

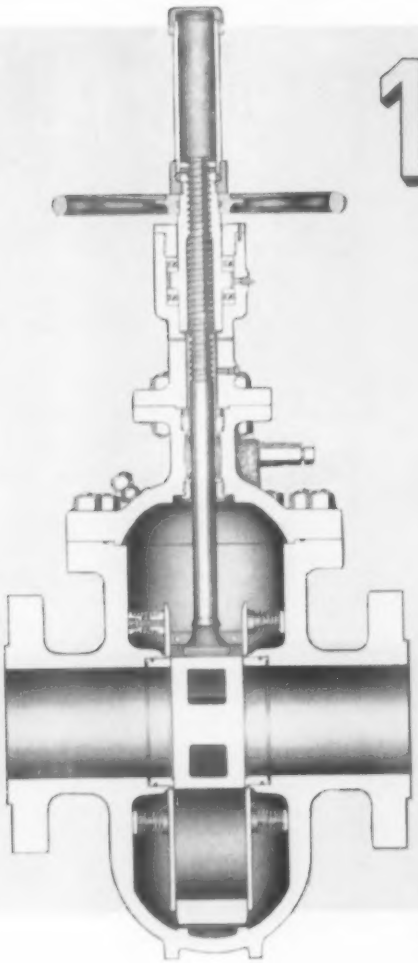
CRUDE-OIL PRODUCTION
(Daily average in thousands of barrels)

Country—	Oct. 1955	Sept. 1955	Oct. 1954
W. Hemisphere:			
Argentina	86.8	86.8	78.3
Bolivia	8.3	8.4	5.5
Brazil	6.4	5.5	3.6
Canada	399.0	363.0	279.0
Chile	8.5	8.1	5.0
Colombia	110.2	111.4	107.8
Cuba	1.4	1.4	0.1
Ecuador	10.0	10.0	8.7
Mexico	240.0	235.3	213.0
Peru	47.6	47.6	47.2
Trinidad	69.8	69.8	65.3
Venezuela	2,215.4	2,183.6	1,912.0
Total	3,203.4	3,130.9	2,725.5
W. Europe and Africa:			
Algeria	1.1	1.1	1.2
Austria*	68.5	69.2	
France	21.3	19.7	13.6
Fr. Morocco	1.9	1.9	2.3
W. Germany	63.9	63.9	56.5
Italy	5.5	5.3	1.4
Netherlands	19.7	20.0	18.3
Egypt	36.6	36.3	37.4
United Kingdom	1.2	1.2	1.2
Turkey	6.4	6.4	1.8
Total	226.1	225.0	133.7
Middle East:			
Bahrain	30.1	30.1	30.1
Iran	350.0	377.0	35.0
Iraq	715.1	728.8	668.3
Kuwait	1,127.0	1,016.5	1,071.6
Neutral Zone	30.0	28.0	18.4
Qatar	119.6	117.3	106.3
Saudi Arabia	1,002.4	959.2	961.5
Total	3,374.2	3,256.9	2,891.2
Other Asia:			
British Borneo	110.0	110.0	97.3
Burma	4.0	4.0	3.7
India	7.5	7.5	7.0
Indonesia	236.0	236.0	238.0
Japan	6.3	6.3	5.7
New Guinea	7.9	8.2	12.7
Pakistan	5.9	5.9	5.4
Total	377.6	377.9	369.8
Total non-Communist foreign	7,181.3	6,990.7	6,120.2
United States	6,831.0	6,731.0	6,135.4
Total free world	14,012.3	13,721.7	12,255.6
Communist controlled countries:			
Russian occupation zone of Austria*			57.5
Romania	125.0	125.0	125.0
Russia	1,285.0	1,285.0	1,185.0
Others	36.8	36.8	36.8
Total	1,446.8	1,446.8	1,404.3
World total	15,459.1	15,168.5	13,659.9

*Austria took over its producing fields from Russia in August 1955.

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Other Communist includes China and Yugoslavia as well as the Soviet satellite countries in Europe.

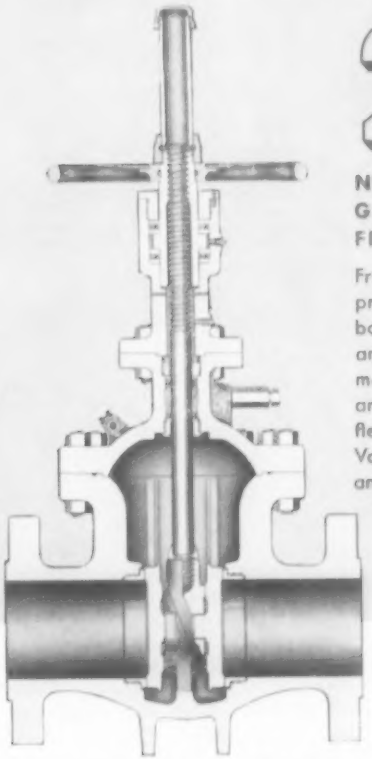
CRANE
Announces Two New
PIPE LINE VALVES



1

NEW CONDUIT-TYPE GATE VALVE
ONE-PIECE DISC; NON-DIRECTIONAL FLOW

Bottom seated, "O" ring-sealed seat rings are self-aligning, and self-sealing on closure—one-piece conduit-type disc uses line pressure for tight seating, does not need excessive stem thrust—spring loaded disc plates prevent loss of grease and entrance of line dirt into body. Sizes, 2 to 30-inch, full-way; venturi patterns also available.



2

NEW DOUBLE DISC GATE VALVE WITH FREE-TO-ROTATE DISCS

Free-to-rotate discs distribute wear, prolong life—machined guides in body accurately control disc clearances—annular wedging surfaces maintain perfect disc alignment and compensate for any body deflections imposed by line strains. Valve operation is easier, surer, and maintenance is greatly reduced. Sizes, 4 to 24-inch.

BOTH LINES OF VALVES HAVE bolted "O" ring-sealed bonnet-joint; 2-piece bonnet and yoke; fully enclosed yoke for stem thread protection and lubrication; plastic packing with injector-check valve; supporting legs cast on body; pressure relief valves.

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B.P. Starts Up Llandarcy Platformer

THE new 6,000-bbl. daily Platformer, at left, was recently commissioned at British Petroleum Co., Ltd.'s Llandarcy refinery in South Wales.

The Llandarcy unit is one of six catalytic reformers the company has built at its refineries. An identical 6,000-bbl. Platformer is operating at British Petroleum's Kent refinery, where alkylation facilities will be added to produce 2,600 bbl. of aviation gas daily.

The units help B.P. meet a rising demand for higher-octane gasoline without sacrificing middle distillates needed to meet an even faster rising demand for fuel oils. The unit shown at right is the 12,500-bbl. daily catalytic cracker at the 90,000-bbl. daily Llandarcy refinery.

Japan Joins Petrochem Parade

JAPAN is an oil-poor country, but it's hopping on the petrochemical bandwagon.

Several plants are scheduled to be on stream by the end of 1958. Their output will range from the latest low-pressure polyethylene to fertilizer and synthetic rubber.

Japan produces only 6,000 bbl. per day of crude oil, or about 5 per cent of her needs. But like some western European countries in the same boat, Japan is going into petrochemicals to take advantage of its sizable refining capacity—some 147,000 bbl. daily.

The government, fed up with wide fluctuations in natural-rubber prices, announced plans to get into the synthetic-rubber business. And it is dangling these incentives in front of private companies to speed up other developments:

. . . **Income tax exemption** for the first few years of operations.

. . . **Duty-free imports** of plant and other equipment for which foreign exchange will be made available.

. . . **Special loans advanced** by the Japan Development Bank

Current projects . . . Four companies have projects under way in Japan.

Mitsui Petroleum Chemical Industries, Ltd., is building an $11 million plant at Iwakuni. The plant will produce 3,600 metric tons of polyethylene annually using the low-pressure Ziegler process. The plant also will produce ethylene oxide, phenol and acetone from liquid propane, and aromatic solvents.

After the plant is completed in about 2 years, Mitsui plans to build capacity for 40,000 metric tons per year of urea and 40,000 tons per year of ammonium sulfate. Facilities for ethylene glycol and dimethyl terephthalate also are planned.

Maruzan Oil Co. is building a plant to turn out propane, isopropyl alcohol, butane and isobutylene, isobutyl alcohol, and methyl ethyl alcohol.

Nippon Oil Co. has a $2,500,000 installation under way to make acetone, isopropyl alcohol, and L.P.G.

Sumitomo Chemical Industries Co. is building ethylene and ammonia plants.

The Mitsubishi group is understood to be considering ventures to manufacture a range of aromatic solvents, and acetone and isopropyl alcohol. The latter would be in conjunction with Shell.

Polystyrene also is coming in for attention. Several American companies are considering building plants.

International BRIEFS

A stepout from a recent wildcat discovery in Emsland district of West Germany has tested gas at the rate of 53,000 cu. ft. per hour through ½-in. choke. The strike, Hebelermeer 4, is about 1,000 ft. west of Hebelermeer 3, an oil discovery. An affiliate of Socony Mobil Oil Co., Inc., Deutsche Vacuum Oil A.G., holds an interest in the concession.

Construction has started on the first refinery to be built in Greece, a 30,000-bbl. daily plant at Aspropyrgos in Attica. King Paul participated in groundbreaking ceremonies. The German affiliate of Hydrocarbon Research, Inc., is building the plant, to be completed in 2 years.

D'Arcy Exploration Co. (British Petroleum Co.) has been granted an exploratory license for the Kamaran Islands and their territorial waters. The company plans to begin geological, gravity, and magnetic surveys soon. The group of British islands is in the southern part of the Red sea off the coast of Yemen. Kamaran, the main island, has an area of 22 sq. miles. The islands are administered by Aden.

Texaco Overseas Petroleum Co. (The Texas Co.) and California Asiatic Oil Co. (Standard Oil Co. of California) were each granted a one-half undivided interest in seven exploration concessions covering 1,235,000 acres in the Cagayan Valley of northern Luzon in the Philippines.

The concession agreements were approved last week in Manila.

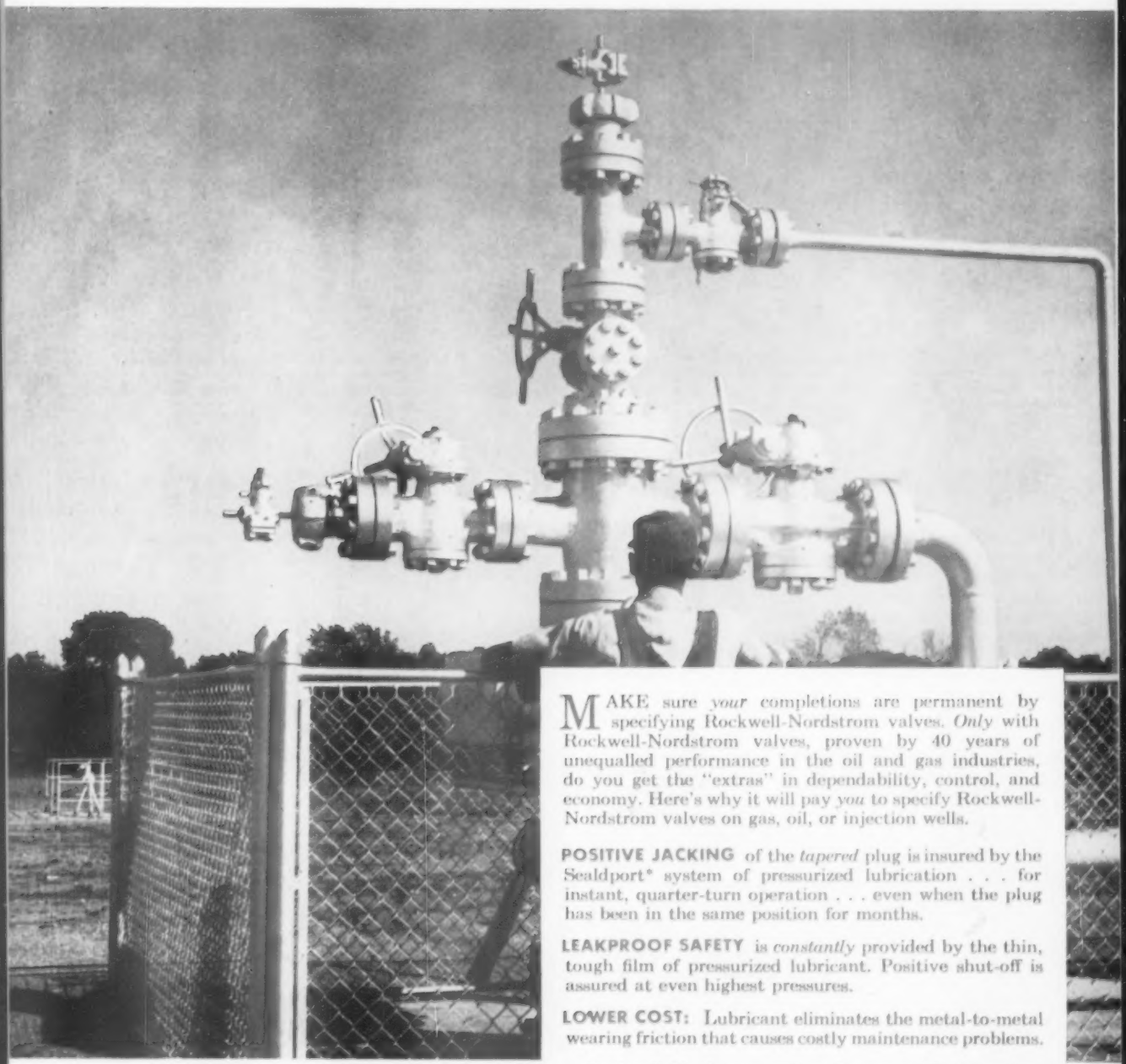
Texaco and Socal normally operate in the Eastern Hemisphere through the jointly owned Caltex companies, but the two have departed from the usual custom in obtaining the new concessions on the one-half undivided interest basis. A single management company will probably undertake an intensive exploration program under contract with the two parent companies.

The Russians have announced the completion of a 825-mile crude pipeline. According to Tass news agency reports, the line connects a field in Bashkir with the Omsk refinery. The reports gave no size or capacity for the line, but said it crosses the Ural Mountain range and several rivers.

Azienda Generale Italiana Petroli (A.G.I.P.) and the French company, Societe Languedocienne des Forages Petroliers, have formed a jointly owned company for exploration in France. The new company is called Societe Internationale des Forages Petroliers.

THIS IS A PERMANENT COMPLETION

It's Controlled By ROCKWELL-Nordstrom VALVES



MAKE sure *your* completions are permanent by specifying Rockwell-Nordstrom valves. *Only* with Rockwell-Nordstrom valves, proven by 40 years of unequalled performance in the oil and gas industries, do you get the "extras" in dependability, control, and economy. Here's why it will pay *you* to specify Rockwell-Nordstrom valves on gas, oil, or injection wells.

POSITIVE JACKING of the *tapered* plug is insured by the Sealdport* system of pressurized lubrication . . . for instant, quarter-turn operation . . . even when the plug has been in the same position for months.

LEAKPROOF SAFETY is *constantly* provided by the thin, tough film of pressurized lubricant. Positive shut-off is assured at even highest pressures.

LOWER COST: Lubricant eliminates the metal-to-metal wearing friction that causes costly maintenance problems.

Rockwell-Nordstrom valves for every Christmas tree service cost no more, often less, than ordinary valves. Made in all pressure classes in carbon and stainless steel and with hard facing for highest pressures. *Available at leading suppliers everywhere or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.*

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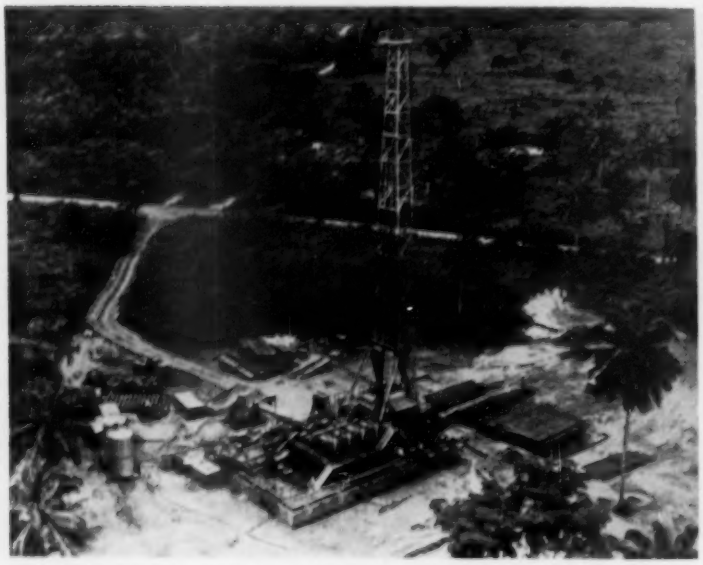
*Registered Trade Mark, Rockwell Manufacturing Co.

40th YEAR *of lubricated plug valve leadership*

ROCKWELL-Nordstrom VALVES

Lubricant Sealed for Positive Shut-Off



WILDCATTING IN NIGERIA is multimillion dollar joint undertaking for Shell and British Petroleum. An American-made rig is drilling an appraisal well at Akata in Calabar Province where promising showings of oil and gas were encountered during deep-test drilling in 1953.

DILEMMA of promising shows but no commercial oil deposits has plagued Nigerian exploration. Most promising area is sedimentary basin of southern coast including delta of Niger River.

Nigerian Search Mocks Oil Explorers

ONE of the most expensive and drawn-out oil exploration programs in history is being undertaken in Africa. A jungle, swamp and bush country which earned the nickname "white man's grave" still is teasing along two of the world's largest oil companies.

The country is Nigeria, a British protectorate on the West Coast. The companies are British Petroleum Co., Ltd., and Royal Dutch-Shell. They are operating jointly through Shell-D'Arcy Petroleum Development Co. of Nigeria, Ltd.

Shell-D'Arcy has sunk more than $31,000,000 into southern Nigeria since it began its first geological reconnaissance 18 years ago. At present, the eleventh well is in progress. Prospects are for further drilling and for even more heavy expenditures.

The exasperating feature about the search is that the country for years has offered encouragement, but little else. Seepages of bitumen have been known for decades. Before World War I, British companies drilled about 15

MUSCLE POWER for coming-out-of-hole operations is provided by Nigerian drilling crews. This drilling-floor scene showing elevator being clamped to string of pipe was taken on rig at Akata during drilling of appraisal well.

MUD TANK with tropical accent is shown here. Native crew members help company engineer stir chemicals into drilling mud to adjust viscosity and specific gravity. This well is at Nzam, 70 miles north of Owerri, main supply base for Nigerian operations.

Youngstown

ELECTRIC WELD LINE PIPE

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ROLLING TUNNELS FOR OIL AND GAS

Thousands of miles of Youngstown Electric Weld Line Pipe are now serving as tunnels for oil and gas. Synchronized sets of forming rolls shape the steel skelp into tubular form. The completed tube passes from the final forming roll through the electric welder which joins the edges in a solid continuous weld. With rigid quality control continued through the final processing operations, Youngstown Electric Weld Line Pipe is ready to become tunnels for oil and gas.

* * *

Four reasons why Youngstown Electric Weld Line Pipe is your best buy: (1) It bends readily; (2) Wall thickness is uniform; (3) Weldability is outstanding; (4) Long lengths save you time and trouble. The Youngstown Sheet and Tube Company, Youngstown 1, Ohio. Sales and service offices throughout the oil and gas producing areas.

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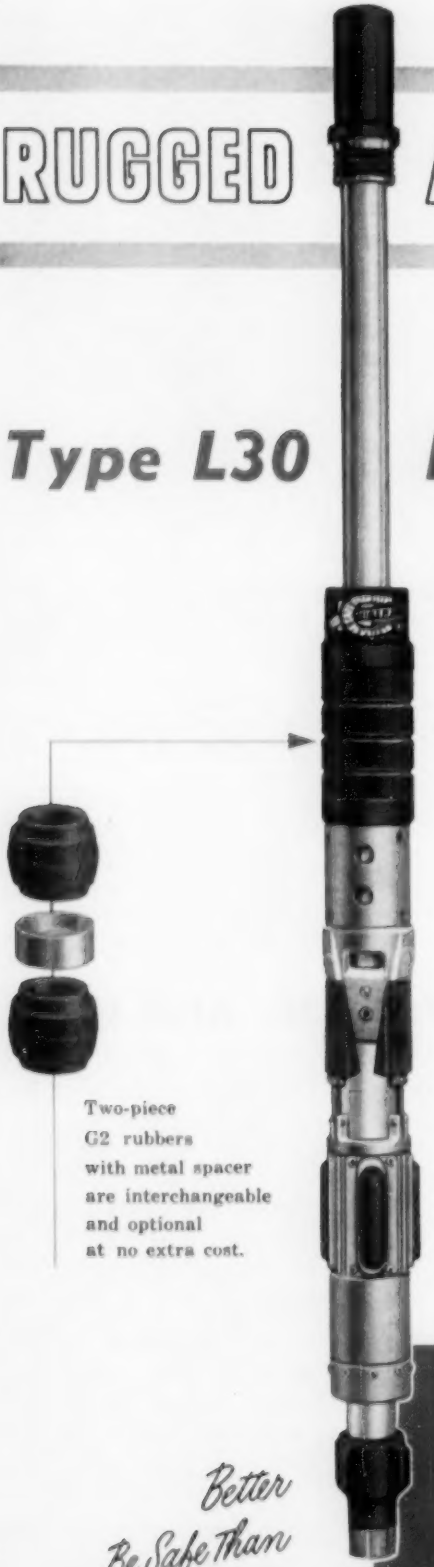
RUGGED AND RELIABLE

GUIBERSON'S

Type L30 Deep Well Packer



Two-piece
G2 rubbers
with metal spacer
are interchangeable
and optional
at no extra cost.

For deep well work with high temperatures and pressures, use Guiberson's dependable L30 Packer. It will give you long valve travel (30 inches) with minimum overall length at no extra cost. You can pull the L30 surely and safely. The fast-action automatic latch, protected by a positive anti-lock device that assures ready release, snaps easily into latched position. Tough, long-wearing friction pads supply ample drag. Packing rubbers of advanced design will not vulcanize to the casing wall. All these features are available on the L30 or the L8 with 8" valve stroke in a wide range of casing sizes. For circulating *above* the packer, Type L30P or L8P with perforated mandrel is available.

Better Be Safe Than Sorry

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

RAINY SEASON in Nigeria adds to troubles of oil explorers. Helicopter in background is one of planes used to transport personnel and materials to many inaccessible areas.

wells, some of them deep for those days.

Oil and gas shows were reported in several tests. But commercial production eluded the early drillers. In the current drilling program, which began in 1951, half a dozen wells have had shows of gas or oil, or both. Commercial deposits, if they exist, however, remain hidden.

Vast area beckons . . . Nigeria is about the size of Texas and Oklahoma combined.

Shell-D'Arcy obtained an exploration license on 58,000 sq. miles, or about one-sixth of the country in 1952. The license covered the sedimentary basin along the southern coast and included the delta of the Niger River, the third longest in Africa.

After the original license expired last year, a new license was taken out on 14,000 sq. miles of the most inaccessible delta area. Twelve prospecting licenses covering about 2,000 sq. miles each were applied for on the promising areas within the remainder of the original license.

The most encouraging area at present is in southeastern Nigeria. Five of the six wells having oil or gas shows are east of the Niger River. Three of these are in Calabar Province within 30 miles of each other. Shell-D'Arcy says that the latest of the tests, at Ekim, shows larger indications than previously encountered in that region and gives grounds for reasonable optimism.

Many problems . . . There are three drilling rigs in operation in Nigeria plus a truck-mounted core-drilling outfit.

Two of the rigs are operated by Shell-D'Arcy and one by Drilvo, a Dutch firm owned 51 per cent by Drilling & Exploration Co., Inc. One rig is drilling at Oloibiri and another at Umuna, Owerri Province. The Drilvo rig, which drilled the Ekim well, is now drilling a stepout well in the Akata area, about 5 miles north.

The jungle and swamp conditions and a virtual lack of roads in many areas make transportation and supply an unusually heavy expense. Shell-D'Arcy maintains a fleet of about 90 cars, jeeps, etc., 120 trucks and trailers, 2 LCM's, an LTC, 6 houseboats, 2 tugs, 10 launches and speedboats, and 3 helicopters. Nearly $3,000,000 worth of equipment is kept in stock at the main supply base at Owerri. Housing and recreation accommodations also are maintained for 200 European employes and their families.

Two American companies recently have taken an active interest in adjacent areas. Socony-Vacuum Oil Exploration Co. (Nigeria) was granted an exploration license last month covering the country's Northern Region. Government of Gold Coast, which lies to the west of Nigeria, has announced that it is negotiating with Gulf Eastern Co., a Gulf Oil Corp. subsidiary, on the subject of oil exploration.

Oil Claims Settled

Austria compensates firms for expropriation in 1938

THE Austrian Government has announced plans for settlement of western oil companies' claims on properties expropriated in 1938.

A government memorandum said that the 6,600-bbl. daily Lobau refinery will be returned to its two owners, Anglo-Saxon Petroleum Co., a Royal Dutch-Shell subsidiary, and Socony Mobil Oil Co., Inc. The companies will be compensated for a pipeline from Zistersdorf to Lobau.

Shell and Standard Oil Co. (N.J.), which had a 50 per cent interest in the 6,600-bbl. daily Korneuburg refinery, will have their shares returned. Shell and Jersey Standard also will receive half interest in Deutsche Gasolin A.G., a marketing firm in West Austria, as compensation for their lost interest in East Austrian marketing.

The government also will begin negotiations with Rohoel-Gewinnungs A.G. (R.A.G.) and Col. R. K. van Sinckle interests on concessions taken over first by the Germans and later the Russians. R.A.G. is jointly owned by Shell and Socony Mobil.

The government does not plan to return the leases to the original owners. In the case of R.A.G., it intends to conclude an operating agreement for development of equivalent production.

Austria obtained control of its oil industry from Russia August 13 under terms of the state treaty signed last spring by Britain, France, the United States, and Russia. Most Austrian crude production, at present about 68,500 bbl. daily, comes from properties originally under lease to foreign companies *(The Oil and Gas Journal, May 16, 1955, page 137)*.

Reds Go Automatic

Remote-control equipment used in Russian gas fields

RUSSIA claims to be using newly developed automatic remote-control equipment in Soviet gas fields where, until now, almost all well regulation has been manual.

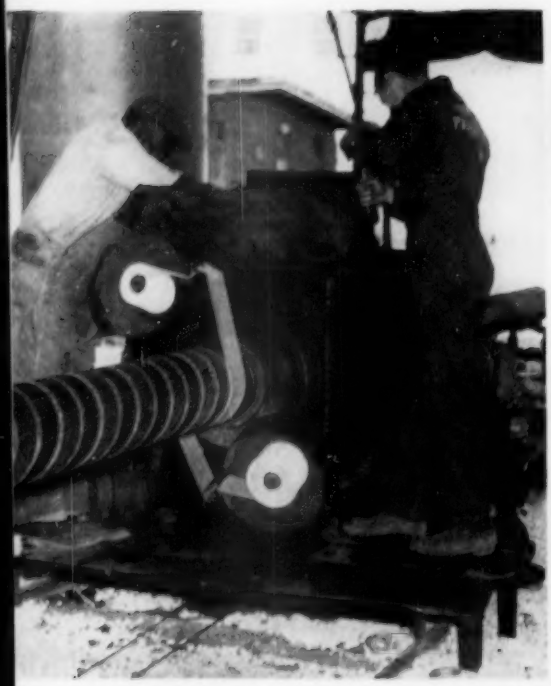
The newspaper Red Star, official organ of the U.S.S.R. Ministry of Defense, reports that one method for automatic regulation of gas wells and gas distribution stations was worked out by the Kiev Institute for Gas Development. The institute, an affiliate of the Ukrainian Academy of Sciences, is testing its equipment at the Drogobych gas fields in the Carpathian Mountain area of the far-western Ukraine.

According to Red Star, "data concerning operation of the gas wells are registered by a recording device and are reflected on a screen at the dispatcher's office. When trouble occurs at any well, a red light flashes and a bell rings. The equipment helps determine the trouble spot and the type of difficulty being experienced.

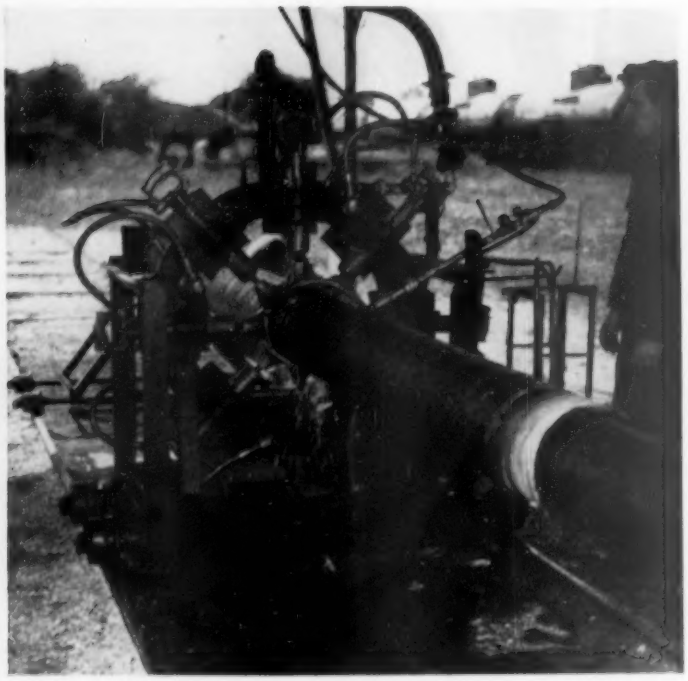
"The operator at the dispatcher's desk then makes the necessary adjustment (or shuts the well down) by pressing the appropriate button." Red Star said that use of this automatic equipment would eliminate the need for many workers now assigned to regular gas well inspection patrols and permit large savings at the Drogobych field, which the Russians describe as the largest in Europe.

Almost simultaneously with the Red Star announcement, the trade union newspaper Trud reported that experimental remote control equipment developed by engineers at Saratov is now being tested at gas wells in that area. It said that wells within a radius of 1½ kilometers can be started or shut down by an operator at a central dispatcher's desk.

"Impulses from the dispatcher's panel are received at the well by a special relay which activates apparatus that opens and closes a pneumatic valve."



COATING IS EXTRUDED onto pipe by this machine. Gauze in coating adds strength and support. Fig. 1.



AIR TAMPERS pack coating, each tamper striking about 2,000 blows per minute to make a dense, tough coating. Fig. 2.

Experience with concrete shows need for

New Method for Coating Offshore Pipelines

Here's the full story on a new coating and coating method —why it was needed, what it is, and how it is applied. As more offshore lines are laid, this coating method promises to play a big part in cutting costs, giving better results.

by P. H. Timothy
Southern Production Co.

THE many difficult and costly problems experienced in laying 200 miles of concrete-coated marine lines for Southern Natural Gas Co. in 1953 indicated a vital need for a satisfactory weight coating material. This need becomes more urgent with increased depths. As the search for oil extends deeper into offshore waters, a protective weight coating which will permit pipelines to be laid at less cost and without damage to the coating is essential. A new coating, Timkote, has been developed to meet these requirements.

Two methods are generally employed for laying marine pipelines. In pipeline canals and relatively shallow waters, the lines are unsupported from a point near the water's surface to the point of contact with the bottom and are thus permitted to sag in a freely suspended curve to the bottom. As depth increases, the unsupported length as well as the maximum curvature of the freely suspended line also increase.

In laying a concrete-coated 12¾-in. line, it was found that serious cracking of the thin outer shell of concrete developed at depths of 12 to 14 ft. when the maximum radius of curvature approaches 1,600 ft. Since the maximum curvature varies as the square of the unsupported length, the extent of cracking of the concrete increases rapidly with depth. In deeper waters it becomes necessary to support the lines beneath the water's surface by means of cradles suspended from the floats as shown in Fig. 6. The vertical movements of the floats due to wave action, however, are transmitted to the pipeline and will cause serious cracking of a concrete coating when the waves reach heights of 4 to 5 ft.

Since the probability of occurrence of such waves any day in the Gulf of Mexico is high, even during favorable periods, a concrete-coated line cannot be laid in deep water without serious damage to the coating.

Timkote conforms to the deflections of a pipe without cracking. Hence, the only limitation on bending a steel pipe when coated with this material is the steel itself. A 12¾-in. pipe can be bent on a radius of about 300 ft. without exceeding the elastic limit of the steel. When coated with this material, pipe-

PIPELINING

Here's why the author set about to develop a new coating

DURING 1953 the author supervised the laying of about 200 miles of marine pipelines for Southern Natural Gas Co. in the swamps and marshes of South Louisiana and offshore in the Gulf of Mexico. These lines varied from 12¾ to 20 in. in diameter and were coated with the conventional enamel and concrete coatings. A description of the work including the method of laying lines to minimize damage to the concrete is contained in an article entitled, "When Pipe Lines Go to Sea," in the January 18 and February 1, 1954, issues of The Oil and Gas Journal.

After spending over 3½ million dollars for coating these lines and especially being confronted with the necessity of maintaining them for many years to come, every effort was made to avoid excessive cracking and loss of the concrete coating. Concrete not only furnished the necessary added weight, but also afforded the only reliable means of preventing penetration of the thin enamel coatings by barnacles. Hence, preservation of the concrete coating was considered essential to the life of the pipelines. Except where required by federal regulations, no attempt was made to bury these lines as they would soon have become uncovered at innumerable locations due to turbulance caused by the many intersecting waterways and tidal variations. Even when buried offshore no assurance can be had that lines will remain buried on account of the erosion caused by littoral currents and wave action.

Handling problems . . . Concrete must be cured for a period of days and, hence, it must be applied ashore at a central coating yard. After coating, it is then necessary to haul the heavily weighted joints to the lay barge. A coating yard is a very elaborate installation, generally requiring several railroad spurs, locomotive cranes, and flat cars for handling the heavily coated pipe. In a coating yard the bare pipe is handled about seven times in applying the coatings. After concrete is applied, it is handled an average of 11 times before it is finally laid.

Some idea of this handling problem can be had when it is realized that the 20-in. lines laid across Lake Pontchartrain for Southern Natural weighed 72 lb. per foot when bare, or 1.4 tons per joint, and 314 lb. per foot when coated or over 6 tons per joint. The difficulty is not so much in lifting the extra 5 tons as it is in handling the joints without cracking or breaking off the concrete. Although the specifications provided that damage within certain limits could be repaired in the field, it soon became evident that attempts to patch cracked or broken concrete were a waste of time and effort. Inspectors were then placed at all handling points to minimize as far as possible the damage to concrete-coated joints in transit.

When pipe is yard coated, the ends must be left bare for welding on the lay barge. After welding, the bare sections must be cleaned, primed, enamel coated and wrapped and then over coated with concrete. The field joints are costly as they must be applied by hand and require the work of seven extra men on the lay barge. The new process described in this article eliminates the field joints. The complete coating application can be made on the lay barge with fewer men than are required to make the field joints alone when concrete is used.

Timkote is firmly bonded to the pipe wall while concrete is generally applied over a felt outer wrap. Hence, the only thing holding cracked concrete on the pipe is the thin wire reinforcement which soon corrodes when exposed by the cracks to salt water. This corrosion subsequently travels along the steel wire and causes further spalling of the concrete.

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lines can be laid to any depth by the method shown in Fig. 6 without damage to the pipe or coating due to wave action, even during hurricanes.

A heavier coating can be made with this material than with concrete when using the same aggregates. It, therefore, provides greater negative buoyancy and requires less material than concrete. Other savings include reinforcing steel, the enamel, the enamel wraps, and curing compounds.

Physical properties . . . Timkote is a tough, pliable, rubberized asphalt mastic. It is highly resistant to shock and vibration and adheres firmly without cracking to the pipe when bent. It provides, in a single application, protection from corrosion as well as the additional weight necessary for marine pipelines. Since curing is not required, this coating can be applied to the pipe on the lay barge after welding and immediately before it is laid in the water.

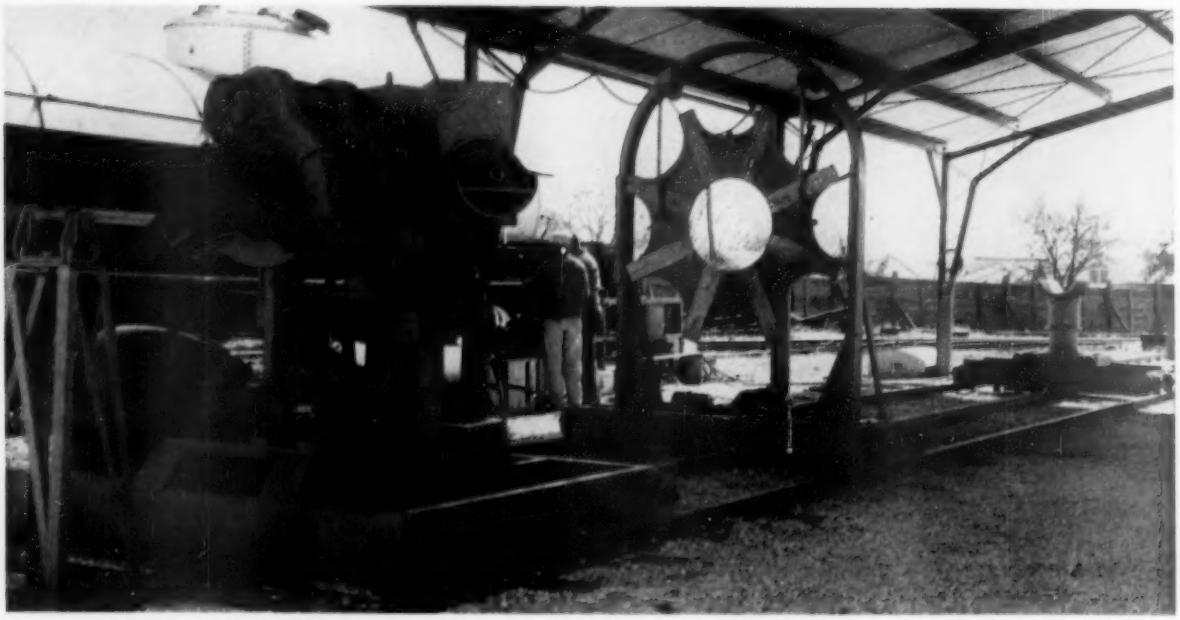
The mixture of rubberized asphalt and barite aggregates is internally reinforced with glass fibers and externally reinforced with a glass mesh outer wrap which further increases its resistance to shock and abrasion. Small-diameter pipes require less weight and aggregates of ordinary sand and crushed limestone may be substituted in various proportions. For soft bottoms a cotton gauze outer wrap may also be used in lieu of the glass wrap. The outer wraps are applied with sufficient tension to firmly embed them in the surface of the coating and to assure a thorough impregnation with the rubberized asphalt.

Laboratory tests show that this material develops an unconfined compressive strength in excess of 800 psi. without deforming. Thereafter, it deforms without internal separation or failure proportionately with load. Under a total load of 60,000 lb. a 4-in. cylinder 2½ in. high deforms approximately to a 6-in. cylinder 1 in. high, giving a compressive strength of 2,000 psi. with a 60 per cent reduction in thickness.

In this connection, the material could deform to a thickness of ¼ in. and still provide a protection equal to that of a double-wrapped and double-coated enamel coating. This deformation under load is only of interest in swamps or bottoms where the line may rest on a stump or other submerged object. It should be noted, however, that in such cases the object would shield the coating from attack by barnacles or other marine organisms.

The relatively thin coal-tar or asphalt anticorrosion coatings previously used are readily penetrated by barnacles. The barnacle biscuit-cuts its way through a mastic coating to a depth equal to its height. In the northern gulf waters the height of the barnacle does not exceed ½ in. and, therefore, a coating having a minimum thickness of ⅞ in. will provide a thickness of ⅜ in. for corrosion protection after the barnacle becomes impaled in the outer ½ in. of coating.

Coating density . . . The mixture weighs 230 lb. per cubic foot when barite aggregates are used. A weight of 240 lb. per cubic foot can be obtained with aggregates of ilmenite and barite. When ordinary aggregates of sand and crushed limestone are used, the mixture weighs 130 lb. per cubic foot. By properly proportioning the aggregates, any desired weight between 130 and



APPLICATION MACHINE is designed to go on marine lay barge. Tamping machine is in background. Fig. 3.

240 lb. per cubic foot can be obtained.

The weight, thickness, and composition of coatings for pipelines laid in water depend upon existing conditions such as the maximum fluid density of the heavily burdened waters at the bottom of canals dredged in swamp or marsh, the dynamic uplift due to bottom turbulence generated by currents or wave action, and the method of laying, especially if the line is laid on bottom and subsequently jetted below bottom.

In general, the heavyweight mix is used for large-diameter pipes, the lightweight mix for small diameters and a combination of the two mixes for lines of medium sizes.

The weights, thicknesses, and compositions of coatings for underwater pipelines having an assumed specific gravity of 1.3 are listed in Table 1.

Coal tar can be used . . . Some difference of opinion exists as to the relative merits of the asphalt and coal-tar coatings. These views are based largely on experience with the enamels which are generally applied in thicknesses of about ⅛ in. The National Bureau of Standards has found that the effectiveness of a corrosion-protection coating is primarily a function of thickness, and, therefore, the relative merits of coatings ⅛ in. thick are of little significance with respect to an asphalt mastic coating having a thickness at least seven times as great.

The additional expense of a coal-tar coating is not recommended for corrosion with this process. However, it can be readily applied at a small increased cost and overcoated with the rubberized asphalt mastic of this process to provide added corrosion protection as well as the needed weight. In this case, the pipe would be given a coal-tar-enamel coating wrapped with glass and then transported to the lay

MIXING of cold ingredients of coating is done in this machine. Fig. 4.

THE AUTHOR

P. H. Timothy has made many significant studies of marsh and offshore pipeline construction along Gulf Coast and Mississippi River delta. He is now with Southern Production Co. and is the developer of the coating described in this article. In 1953 he served as special project engineer with Southern Natural Gas Co. in its program of building 200 miles of marsh and offshore lines. His prime concern in that service was devising effective design and laying methods for marine pipelines. Timothy was recently retired from the Army with the rank of brigadier general. He had served as an engineering officer after his graduation from West Point in 1918 and M.I.T. in 1921.

TABLE 1—PROPERTIES OF COATINGS FOR MARINE PIPELINES

Pipe size (in.)—	Weight (lb./cu. ft.)	Thickness (in.)	Compositions
6⅝ by ¼ to 10¾ by ⅛	130	⅞* to 1⅛	Asphalt, sand, limestone, glass.
12¾ by ⅛ to 18 by 11/32	170	1⅛ to 2	Asphalt, barites, sand, limestone, glass.
20 by 11/32 to 24 by ⅛	210	1¾ to 2	Asphalt, barites, limestone, glass.
26 by ⅛ to 30 by ½	230	2 to 2½	Asphalt, barites, glass.

*In fresh water a coating thickness of only ⅜-in. instead of ⅞-in. is required for the 6⅝-in. by ¼-in. pipe. All larger sizes require the same thickness in fresh water as that shown for salt water.

barge where the coating of this process would be applied.

But asphalt preferred . . . Normally asphalt would be used without coal tar. The instrumentality of asphalt mastics when exposed to severe climatic conditions or when submerged in fresh salt water is evidenced by their use for:

1. Highways and airport runways in all climates and all conditions of ice, snow, and rainfall.

2. Jetties and shore protection works. The Galveston jetty was capped with asphalt mastic over 20 years ago and shows no indication of deterioration.

3. Revetments and bank pavements. Asphalt mastic has been used for many years to revet the banks of the Mississippi River. One of the oldest engineering structures still satisfactorily serving the purpose for which originally designed is an asphalt mastic revetment at Assur on the Tigris River built about 1300 B.C.

Recently an 8-in. pipe coated with ½-in. thickness of asphalt mastic was exposed to the ocean waters near San Francisco for 3 years. The conductivity of this coating was measured at various intervals during this period and was found to be infinite. Finally, at the end of 3 years, the conductivity was again measured with a Wheatstone bridge having a capacity of 10 million ohms, and as no trace of conductivity was observed, the test was abandoned.

Not only is the asphalt used in this material of the highest quality obtainable for marine work, but an additive of synthetic rubber is used to form an amalgam with the asphalt. The addition of this rubber greatly increases the dielectric strength of the coating and practically eliminates any tendency to absorb water. This additive also increases the ductility and flexibility of the material and greatly reduces its sensitivity to temperature changes.

Primer . . . The pipe in this process is flame-dried and gritblasted immediately before priming. Almost 1 year was required to develop a primer which would:

1. Form a complete seal between pipe and coating by filling depressions in the surface of the coating as well as those in the pipe surface.

2. Provide a plastic, waterproof bond tougher and stronger than the coating material itself.

3. Be sufficiently ductile to permit a slight displacement of the coating without cracking when the coating is deformed under a reasonable impact and to absorb the vibrations of the pipe wall incident thereto without breaking the seal.

The primer used with this coating develops a bond strength in excess of 80 psi. between the coating and pipe wall. It forms a firm seal which can be broken only after destruction of the coating itself. Tests show this primer will remain "alive" for as long as 3 weeks after application and before coating.

How Coating Is Applied

Before attempting the design of equipment for the application of this material, a careful study was made of the existing methods of applying the coal-tar and asphalt coatings. It was realized that a different technique would be required to apply successfully a coating of such greater weight and greater thickness. The conventional coatings are applied and compacted at about the mixing temperature, 350° to 400° F.

It was concluded that compaction at low temperatures, at which the internal volatilized gases had condensed and at which the entrained air bubbles exerted far less pressure, would be more effective and would result in a much denser material. Denser material would not only be heavier but it would also be more resistant to the absorption of water. Furthermore, a lower temperature would permit the binder itself to become sufficiently adhesive to hold the aggregates in the mixture firmly together when compacted.

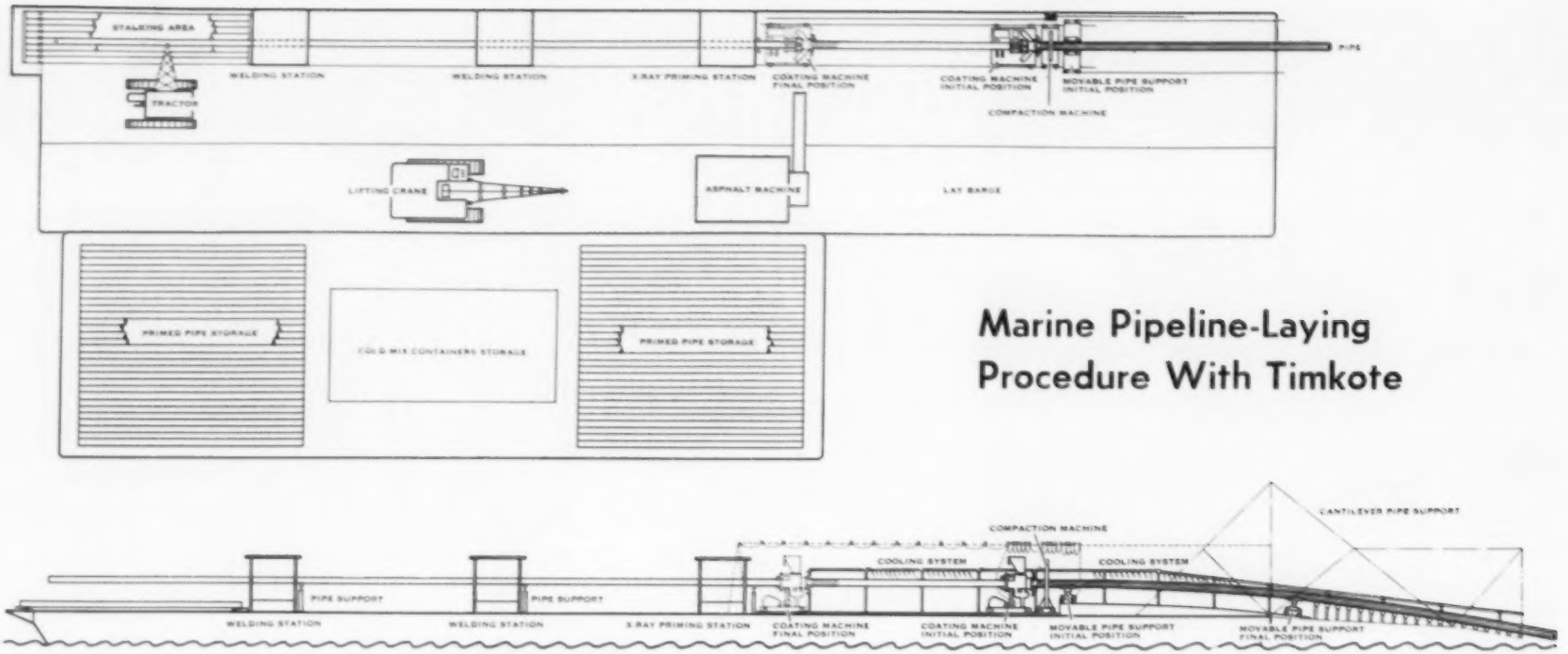
Therefore the application equipment, Fig. 1, is designed to form the material about the pipe, by extrusion with the least amount of work at a temperature about 100° F. below the mixing temperature. As the material emerges from the nozzle, it adheres firmly to the pipe due to the internal reinforcement of glass fibers uniformly dispersed in the mix. The material is further supported about the pipe by embedding, under tension, a wrapper in the outer surface as the coated pipe leaves the nozzle. Thereafter the coating is compacted against the pipe by means of a separate machine, Fig. 2, which consists of multiple air tampers radially arranged about the pipe axis.

A water spray is applied to the coating immediately ahead of the tampers to prevent asphalt from sticking to the metal tampers and to chill the outer surface so as to better distribute the force of the impacts throughout the coating material. High-frequency impacts or vibrations are imparted radially by the tampers. When operated at a pressure of 90 psi. each tamper delivers about 2,000 blows per minute against the coating. This radial compaction against the pipe wall produces a denser, tougher material and also assures complete contact by the primer with the coating and with the pipe wall. After compaction, a water spray is again applied to the coating. A coating 1 in. thick can be cooled to water temperature in about 5 minutes.

Fig. 3 shows the production equipment under construction in the yards of Equitable Equipment Co. in New Orleans. The application machine is in the foreground and immediately behind it is the compaction machine. On the lay barge the coating machine moves along the pipe and coats successive increments as the joints are welded and while the pipe is stationary. The equipment is, therefore, mounted on carriages which travel along rails laid on the deck of the barge, and which are driven by pinions meshing in the rack laid between the rails. The third carriage carries a movable pipe support consisting of a saddle, 3 ft. in length, which provides a distributed support at a point where the coating is only partially cooled.

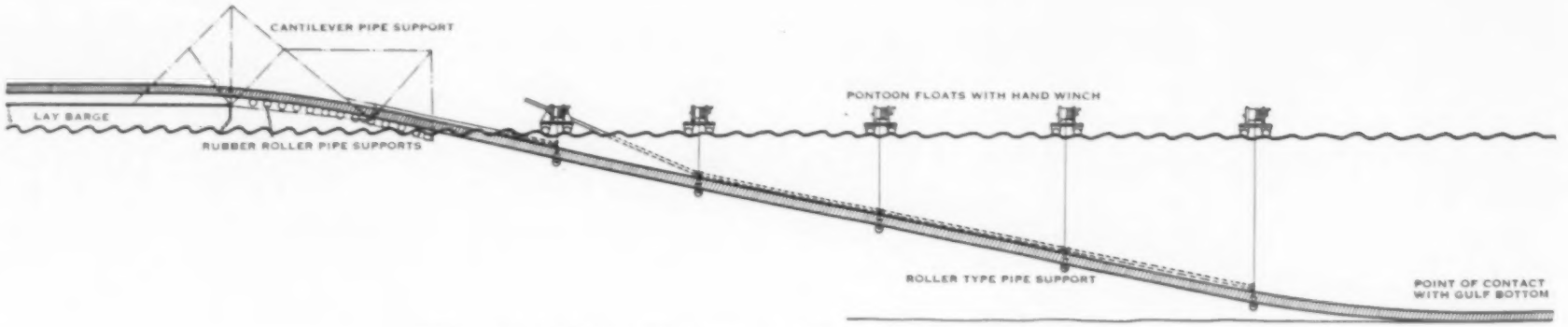
The layout shown in Fig. 3 simulates the deck of a lay barge and the equipment being erected thereon can be transferred directly when completed

"The addition of rubber greatly increases the dielectric strength of the coating and practically eliminates any tendency to absorb water. This additive also increases the ductility and flexibility of the material and greatly reduces its sensitivity to temperature changes."



Marine Pipeline-Laying Procedure With Timkote

LAY BARGE and supply barge, seen from top and side view. Note how coating machine moves back and forth the length of one joint. Fig. 5.


CANTILEVER PIPE SUPPORT
LAY BARGE
RUBBER ROLLER PIPE SUPPORTS
PONTOON FLOATS WITH HAND WINCH
ROLLER TYPE PIPE SUPPORT
POINT OF CONTACT WITH GULF BOTTOM

PIPELAYING METHOD for deep water uses pontoons to partially support pipe between barge and Gulf bottom. Fig. 6.

to a lay barge with all parts necessary for actual production. Electric motors are of the totally enclosed type and other equipment are likewise weatherized for marine use. This equipment is designed to coat pipe up to and including 14 in. in diameter. It is only necessary to insert the proper nozzle size in the application machine and to adjust the tampers in the compaction machine to change pipe diameters of the thickness of a coating. Hopper capacities, motor sizes, and similar considerations indicate a desirability for three standard machine sizes for coating pipe varying from about 6 to 30 in. in diameter, one machine for 6 to 14-in. pipe, one for 16 to 22-in. pipe, and one for 24 to 30-in. pipe.

Fig. 4 shows the type of mixing equipment used for marine work. It was found impractical to haul, batch, and mix the separate ingredients on the lay barge by the methods and equipment ordinarily used for asphalt mixes. A greatly simplified process has been developed through the use of an attenuated rubberized asphalt. This process permits mixing of all ingredients cold ashore in a machine about the size of that shown in Fig. 4.

When cold mixed, the mixture resembles a damp, brown sand. It can be stored before using for many months in any type of container which will protect it from direct rainfall. When delivered to the lay barge, the material is put into a hot mixing machine about twice the size of that shown in Fig. 4 and brought up to a temperature of about 350° F. in approximately 5 minutes. It is then conveyed to the coating machine where it enters the hoppers at a temperature of about 250° F.

New Coating Simplifies Laying

Fig. 5 shows the lay barge and the supply barge. The supply barge carries primed pipe as well as containers filled with the cold coating mixture. Extensive tests of the primer used in this process under various conditions of exposure have shown that no evidence of corrosion of the steel or of the deterioration of the primer itself occur for periods as long as 3 weeks. Hence, the pipe is primed ashore at the base of operations where the coating ingredients are also cold mixed.

Two supply barges are required for each marine spread and each barge carries sufficient primed pipe and coating mixture for at least 2 days of operations. It will be noted that heating kettles, doping and wrapping materials, concrete mixers, sand barges, reinforcing steel, steel forms, banding straps, and other paraphernalia ordinarily used for coating the field joints on the lay barge are not required with this process.

"This new coating not only provides in one application at less cost the weight as well as the corrosion protection required for marine pipelines, but it also permits such lines to be laid in deep water without damage to the coatings."

Any type of sea-going barge having a length of about 220 ft. can be used for laying pipe by this method. No extensive conversion is required. With concrete-coated pipe, a ramp must be constructed either along the top of the barge or alongside the barge. In lieu of a ramp, adjustable pipe supports are sometimes used to permit the gradual sloping of the line along the deck of the barge so as to obtain an equivalent slope at the point where it enters the water.

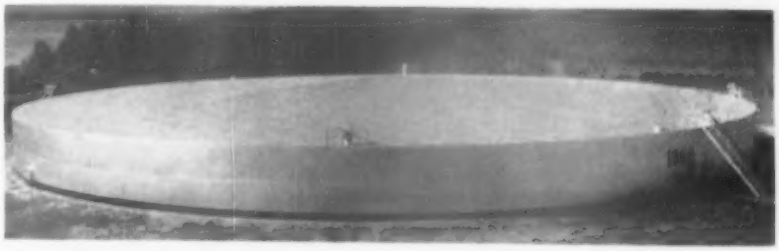
Since the necessary bending of the pipe coated by this process can be done at the rear of the barge, the pipe is carried parallel to the deck until the welding and coating operations are completed. Note that the first three work stations are the same as those used when laying yard-coated pipe.

After the barge is moved forward, the coating machine moves along its rails and coats a length of pipe equivalent to the length of one joint. At the forward position, the hopper of the coating machine is refilled with the hot mixture. The machine is then clamped to the pipe and moves back with the pipe for the next cycle. Although the speed of coating can be regulated, the machine will normally coat one joint of pipe in about half the time required for welding.

As the coating machine moves forward, the weight of the pipe immediately rearward of the machine is taken up by the movable support which also moves back on rails with the pipe when the barge is moved forward. Upon reaching the rearward position, the saddle of the movable support is automatically lowered and the carriage moved forward by remote control. Cooling water within range of movement of coating machine is automatically applied to the coating in rear of the coating machine. The compaction machine follows the coating machine by remote control. When the coating machine stops at the end of its run, the compaction machine closes on the coating machine and then moves back with the coating machine when the barge moves forward.

The method used for laying pipe by this process in deep water is shown in Fig. 6. The pipe and the coating can readily conform to the oscillations of the submerged floats without damage even under hurricane wave conditions. With the approach of a storm it may become necessary to move the floating equipment to sheltered waters. In this case, the pipe can be coated to its end, the end capped, and the pipe lowered to bottom by the winches on the floats. After the storm has subsided, the pipe can then be raised in the same manner for the resumption of operations.

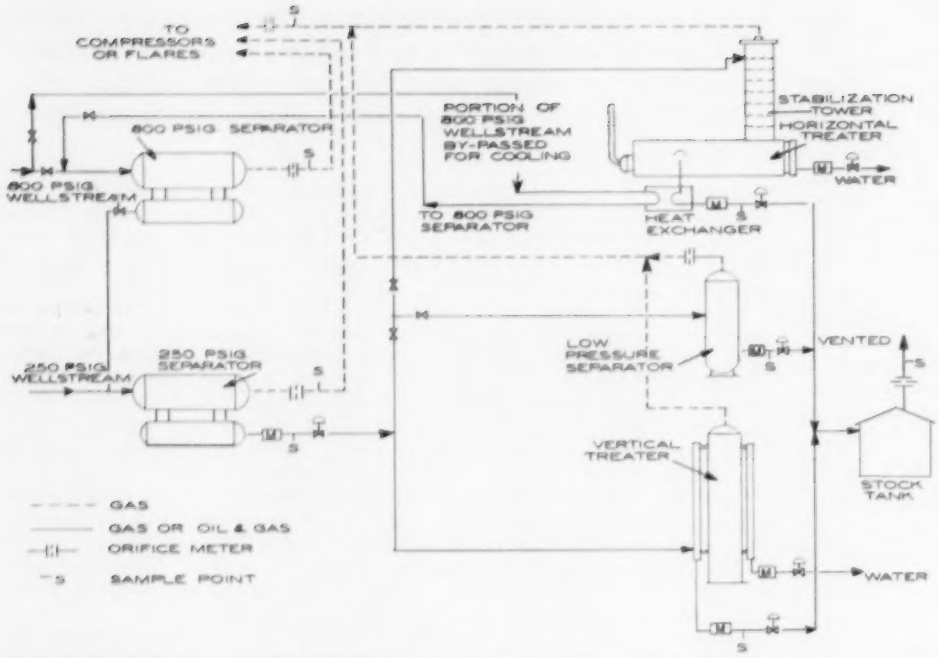
From the above, it is seen that this new coating not only provides in one application at less cost the weight as well as the corrosion protection required for marine pipe lines, but it also permits such lines to be laid in deep water without damage to the coatings. In rocky areas this coating also provides in one application a shield to prevent damage by the rock as well as an anticorrosion coating. In corrosive soils, it again provides a dual protection from corrosion and from soil stresses.



Big Tank Sits Light

HERE'S a tank designed for soils which can't stand heavy bearing loads. The big crude-oil tank has a diameter of 200 ft., a height of 14 ft., and a capacity of 78,000 bbl. It's placed on a sand cushion and exerts a bearing load of only 800 lb. per sq. ft., about one-third of a standard 80,000-bbl. tank.

This and another identical tank are located at Gulf Refining Co.'s marine loading terminal at Ostrica, La. The tanks were built for Gulf by Chicago Bridge & Iron Co.



FLOW DIAGRAM of lease-oil stabilization equipment. The three low-pressure treating units at right were tested alternately on the same crude stream. Fig. 1.

Lease-Oil Stabilization Pays Off

Field unit retains more than half of butane and most of the gasoline and heavier components in stock-tank oil

by C. V. Hornback

RECENT attention has been focused on the potential economic advantages of stabilizing oil on the lease, in order to increase the stock-tank recovery per barrel of reservoir fluid and reduce tank vapor losses. This advantage is particularly noticeable when a relatively light crude is being produced from flowing oil wells where reasonably high reservoir pressures exist.

Because of this reservoir pressure the oil contains a high percentage of propane, and lighter, which is evolved as vapor on pressure reduction at the surface. When these vapors flash off they carry a correspondingly larger amount of stock-tank components which results in lower recovery and higher gas-oil rates.

When using heater-treaters, stock-tank vapor losses are low but a relatively large amount of butane and gasoline leaves that vessel in the vapor phase. In those fields where this vapor is processed and the liquid content removed this poses no serious disadvantage. In the absence of this processing the use of a treater-stabilizer offers probable advantage.

The crude oil processed by Sun Oil Co. in Millican field, Coke County, Texas, is representative of this type of production. The average daily production is 1,400 bbl. per day, produced at various pressures. Approximately 60 per cent is three-staged, 35 per cent two-staged, and 5 per cent single-staged. At present about 90 per cent of this production is being processed through four B.S. & B. treater-stabilization units.

For this reason a carefully controlled production test was run to determine the relative efficiency of these stabil-

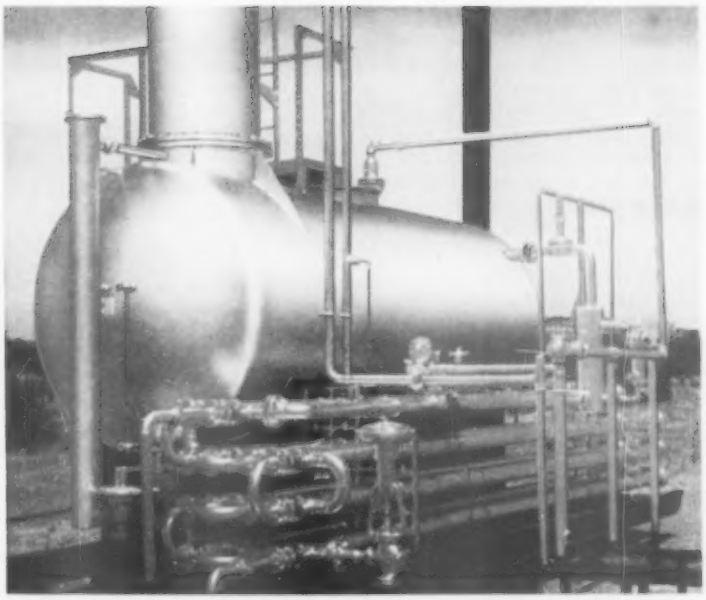
FIELD PROCESSING

TABLE 1—MATERIAL BALANCE OF VOLUMES PRODUCED DURING EACH TEST
(All volumes in barrels)

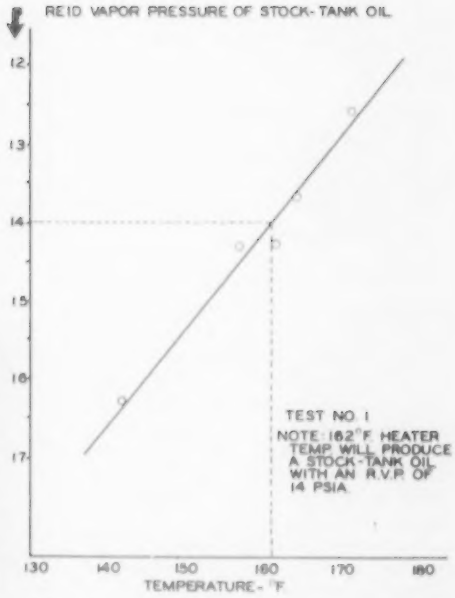
Test number—	800-psi. gas	250-psi. gas	250-psi. oil	Low-pres. gas	Stock-tank oil	Stock-tank vapor
Test No. 1 field—Stabilization unit 30 psi.	3,518.32	1,203.13	1,000.00	155.28	840.30	4.42
Test No. 2 low—Pressure separator 30 psi.	3,387.01	1,309.92	1,000.00	102.64	846.96	50.40
Test No. 3 vertical—Heater treater 20 psi.	3,602.88	1,418.94	1,000.00	240.88	731.29	27.83
Test No. 4 field—Stabilization unit 20 psi.	4,683.65	1,761.96	1,000.00	168.82	823.77	7.41
Test No. 5 horizontal—Heater treater 20 psi.	4,405.63	1,694.56	1,000.00	198.61	793.86	7.53

Note: In all gas streams noted above the volume of gas evolved has been converted to equivalent barrels.

Author is with Sun Oil Co., Brookhaven, Miss.



TREATER-STABILIZER used in test No. 1. This was the most economical of the low-pressure separation units. Fig. 2.



EFFECT OF HEATER temperature on vapor pressure of stock-tank oil leaving treater-stabilizer. Fig. 3.

ization units in comparison to simple low-pressure separation and heater-treaters.

Test Procedure

A total of five tests were run over a period of 6 weeks using the test setup shown in Fig. 1. On all of the tests the same wells were used, three flowing directly to the 260-psig. separator and the remainder to the 800-psig. separator.

Test No. 1 . . . The low-pressure vessel for this test was a treater-stabilization unit operating at 30 psi. and 163° F. Approximately 58 per cent of the production was three-staged and the remaining 42 per cent was two-staged. In order to maintain a fairly constant composition of oil from the 250-psi. separator, all tests were conducted with the wells flowing on the same size choke and in the same separator.

During this test samples were collected from the 800-psi. gas, 250-psi. gas, 250-psi. oil, low-pressure gas, oil from the heat exchanger before pressure reduction, and stock-tank vapor. Composition of stock-tank oil was calculated by a material balance of the stock-tank vapor and oil from the heat exchanger.

Gas from the three stages was metered through the gas department's orifice meters in the gathering system to the compressor station. Stock-tank vapor was measured by a positive-displacement meter.

As a check on measurements, two positive-displacement liquid meters were used to meter oil from the 250-psi. separator and low-pressure vessel. The meter measurements checked within 3 per cent of the volumes calculated by a material balance, but the material-balance volumes were used as a basis for calculations in this report.

In order to determine the heater temperature necessary to produce a stock-tank oil with a Reid vapor pressure of 14 psia., the temperature was varied while maintaining a constant pressure of 30 psi. The vapor pres-

TABLE 2—VALUE OF RECOVERABLE LIQUIDS BASED ON 1,000 BBL. OF FEED STREAM TO EACH LOW-PRESSURE VESSEL

Assumed: 2 cents per gallon propane with 60 per cent recovery, 3 cents per gallon butane, 8.5 cents per gallon gasoline, and $2.90 per barrel for oil.

	800-psi. gas	250-psi. gas	Low-pres. gas	Stock-tank oil	Stock-tank vapor	Net stock tank profit
Test No. 1	$443.49	$187.50	$ 79.10	$2,436.87	$ 6.27	$2,430.60
Test No. 2	444.15	215.12	45.46	2,456.18	40.13	2,416.05
Test No. 3	364.45	216.08	203.35	2,120.74	38.79	2,081.95
Test No. 4	510.86	324.08	116.85	2,388.93	11.13	2,377.80
Test No. 5	521.82	256.34	183.82	2,302.19	9.28	2,292.91

Note: Wet stock-tank profit is the value of the vapor loss deducted from the value of the oil.

TABLE 3—PER CENT STOCK-TANK RECOVERY OF CHARGE TO LOW-PRESSURE VESSEL

(Based on 1,000 bbl. of 250-psi. oil for each test)

Test No. 1 Field Stabilization Unit Operating at 30 Psi.

	Oil from 250-psi. sep.	Low-pres. gas	Stock-tank vapor	Stock-tank oil	Per cent recovery feed stream
Propane	81.70	67.26	1.29	13.15	16.1
Butane	93.10	21.05	2.39	69.66	74.8
Gasoline	147.38	6.23	0.69	140.46	95.3
Heptane +	617.69	0.62	0.04	617.03	99.9

Test No. 4 Field Stabilization Unit Operating at 20 Psi.

	Oil from 250-psi. sep.	Low-pres. gas	Stock-tank vapor	Stock-tank oil	Per cent recovery feed stream
Propane	78.04	67.44	1.97	8.63	11.1
Butane	80.00	28.49	3.32	48.19	60.2
Gasoline	163.35	11.36	1.52	150.47	92.1
Heptane +	618.45	1.82	0.15	616.48	99.7

Test No. 5 Horizontal Heater Treater Operating at 20 Psi.

	Oil from 250-psi. sep.	Low-pres. gas	Stock-tank vapor	Stock-tank oil	Per cent recovery feed stream
Propane	81.51	66.59	2.76	12.16	14.9
Butane	87.58	45.02	2.61	39.95	45.6
Gasoline	144.89	22.87	1.15	120.87	83.4
Heptane +	622.32	3.33	0.14	618.85	99.4

sure of stock-tank oil was checked for each change in temperature as shown in Fig. 3.

Test No. 2 . . . The low-pressure vessel in this test was a separator operating at 30 psi. and 32°-57° F. Stock-tank vapor was measured with a 2-in. orifice well tester. Other volumes were measured the same as in test No. 1.

Test No. 3 . . . The low-pressure vessel in this test was a standard vertical I.C.P. treater. The fluid level in the top and bottom compartments in this unit would fluctuate resulting in a surge of hot oil to the stock tank. The hay was removed from the treater and the gas equalizer between the top and bottom compartments was checked for deposits in order to determine the cause of the fluid surge.

It was finally decided that gas breaking out of solution in the 7-in. downcomer and lifting oil to the top section would result in a fluid surge. To check this possibility the treater temperature was gradually reduced to 110° F. before the unit would operate properly. This may serve as a caution where this type treater is used to treat volatile crude oil, for it may be necessary to preheat the oil to the top section.

This unit was tested at 19.3 psi. and 143° F. Stock-tank vapor was measured with an orifice well tester as in test No. 2. Other volumes were measured the same as in test No. 1.

This test was run only to determine the efficiency of the treater while operating with a fluid surge. Recovery figures for this unit should not be compared to the field stabilization unit or horizontal treater because the unit was not working properly during the test period.

Test No. 4 . . . The low-pressure vessel in this test was the field stabilization unit operating at 20 psi. and 141° F. Stock-tank vapor was measured with a positive-displacement meter. Other volumes were measured the same as in test No. 1.

Test No. 5 . . . The low-pressure vessel in this test was a horizontal heater-treater operating at 20 psi and 138° F. The feed stream entered the heater through the gas equalizing line to the water siphon which bypassed the stabilizer. This was a rather unconventional arrangement but was satisfactory for testing purposes.

Test Results

Table 1 summarizes the material balance obtained during the tests, with all gas figures converted to equivalent barrels. Since it appeared that the gas-oil ratio increased during the test a basis of 1,000 bbl. of oil from the 250-psig. separator was used for all calculations instead of reservoir fluid.

A comparison of tests No. 1 and No. 4 shows that use of the higher pressure resulted in greater stock-tank recovery with less vapor loss. This is expected from previous experience with condensate on conventional stabilizers.

Fairest Comparison

The best and fairest comparison between stabilization and conventional treating is offered by tests 4 and 5 since the two units were operating at the same pressure. The results in Table 1 show that the stabilizer produced 3.8 per cent more oil than the treater with about the same tank vapor loss. From Table 2 this difference in stock-tank oil profit is $86.74 per 823.77 bbl. of stock-tank oil. Assuming an average daily production of 1,300 bbl. through the unit this represents an additional net increase in daily revenue of $137 without incerasing the rate of production.

The additional oil recovered by stabilization in test No. 4 is mainly butane and gasoline. From Table 3, test 4, this unit recovered 14.6 per cent more butane and 8.7 per cent more gasoline than the treater in test 5. Both units recovered virtually all the heptane and heavier components. The stock-tank oil in test 4 also contained 3.8 per cent less propane.

Test No. 2 resulted in the highest stock-tank recovery but also showed the highest vapor loss. The values shown in Table 1 have been corrected for the vapor loss during the test from oil produced into the tank prior to the test. Stock-tank oil from this test was allowed to weather for 72 hours resulting in a loss of 2.98 bbl. No measureable weathering losses were encountered on the other tests.

A comparison of tests No. 1 and No. 2 shows that although the separator produced the most oil by about 0.8 per cent the vapor losses were about 1,100 per cent higher. The last column in Table 2 further shows that test 1 yields a greater net profit of $14.55 or about $23 per day (1,300 bbl.) when the vapor losses are considered.

Conclusions

1. The field stabilization unit was effective in retaining over half of the butane and most of the gasoline and heavier components in the stock-tank oil.

2. The field stabilization unit increased stock-tank oil recovery by 3.8 per cent over heater treater operations with no appreciable increase in vapor loss.

Does Your

by C. H. Dragert

LUBRICATION for properly engaging the threads of pipe joints is highly essential for running drill pipe and casing. But equal importance should be attached to the sealing nature of lubricating thread compounds.

To a plumber, a thread compound would be a mixture of linseed oil and white lead. These components effectively help the plumber engage his pipe threads with low wrench torque and provide an adequate leakproof seal for water-supply systems.

However, as the demand for leakproof resistance increases from mere hundreds of pounds per square inch for the water systems to thousands of pounds per square inch for oil-well systems, the requirements of thread compounds take on a markedly different aspect. Here the use of the proper type of compound may save much grief and money.

Why lubricants must seal . . . Small leakage motivated by a pressure of 1,000 psi. along thread capillaries can quickly destroy a whole joint. Such accidental leaks are called washouts, with all the disastrous effects that the name suggests. Washouts of drill-pipe tool joints or drill-collar joints can become very costly if allowed to occur often. A washout in a casing line several thousand feet deep and after the well has been cemented in could be ruinous, or at least a very expensive occurrence.

For a number of reasons, no threaded joint can be made up perfectly pressuretight without a sealant. Surface imperfections follow from thread-cutting operations. And damage, however slight, is bound to occur in handling and transporting. The possibility of the existence of a continuous-thread capillary is further increased by incomplete thread engagements as well as imperfect mating.

For these reasons, a good sealant is necessary in high-pressure pipe systems. It minimizes imperfections in the threads and establishes a barrier in the thread capillaries.

Properties of good compounds . . . Essentially, then, a good thread compound is both a lubricant and a sealant. As a lubricant it eases friction between sliding surfaces. It has the ca-

Author is president of C. H. Dragert Co., Dallas. Material presented at A.S.M.E. Petroleum Mechanical Engineering Conference, New Orleans, September 1955.

Thread Lubricant Do the Job?

Drill-pipe and casing string makeup imposes high torque and stresses on the threaded joints. When run into the hole, these joints must stand high pressures without leaking. A good thread lubricant must not only lubricate the joints and prevent galling, but also must seal the threads.

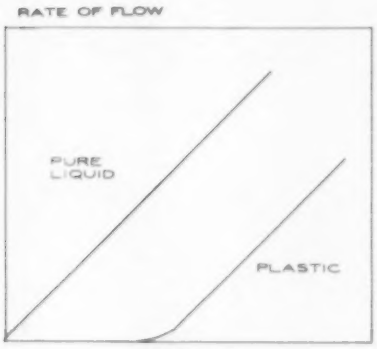


Fig. 1—Pressure-flow diagram.

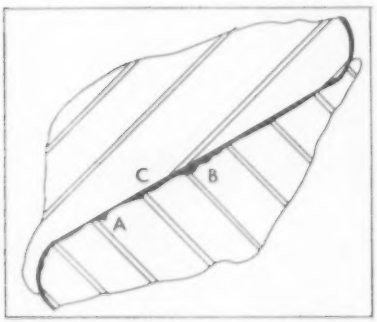


Fig. 2—Metal surface lubricant system.

pacity for good adhesion, and must also have the quality of being spread into a thin, continuous film.

Although few straight lubricants are characterized by plasticity, the thread compound which moves by plastic flow is the most attractive. This type of material has a high resistance to flow from capillaries because of high pressures, but still lubricates during the high stress of thread makeup. Certain metals provide the most effective plastic compounds of thread lubricants.

Why plasticity . . . In thread makeup, the efficiency of motion is not so important as the effect of the motion during the time a force is applied. In other words, it is important to consider the motion or flow of a lubricant as well as the surfaces that confine it.

By definition, a plastic material will resist a distorting force until the yield value of the material is reached. Therefore it may be distorted continuously and permanently without rupture. If the force is increased still further, the plastic will flow like a true liquid. This is represented by a typical pressure vs. rate-of-flow diagram (Fig. 1).[1]

The capacity to resist rupture is very important in the makeup of a high-pressure joint where the applied torque may often exceed 2,500 ft.-lb. Surface irregularities could more easily penetrate a nonplastic film and result in grooving or galling.

Fig. 2 is a schematic picture of a round thread section. Surface irregularities have been exaggerated for reasons of clarity. Points A and B indicate areas of small slow motion, but the flow around point C would be relatively rapid. A plastic lubricant would yield only along a thin sheet in the middle of the capillary at A and B, but would be more nearly fluid at C. This condition is probably ideal because it tends to localize areas of friction and helps to protect the continuity of the lubrication.

Metals are important . . . The main benefit derived from the use of metallic thread compounds on tool joints is the antigalling factor.

Some pure metals, notably aluminum, zinc, lead, tin, copper, silver, and gold are easily malleable. They are not physically destructible, and in the solid state they do exhibit the characteristics of plastic flow.

Among the most malleable of these, and one of the least expensive, is lead. Lead also has the property of particle coalescence, so that a layer of powdered lead may be formed into a thin sheet by combined shear and compression. Such properties indicate an ideal material for plastic lubrication, and, as a matter of fact, lead and zinc have been included in commercial thread compounds for more than a decade.

Best use of metals . . . One of the most outstanding applications of these metals in thread compounds is the present A.P.I. high-pressure thread-compound formula. The development of this compound by Dr. M. G. Mayberry and associates is an example of objective research followed by immediate, successful industrial application.[2] The results of this research and the A.P.I. formula have been dedicated to public use and neither license nor franchise is required for its production.

Table 1 shows the components of the A.P.I. thread compound. Here we see the combined use of lead, copper, and graphite as lubricants. Zinc, though malleable and having plastic tendencies, does not exhibit an expected lubricating aid under torque up to 2,500 ft.-lb., but serves as a sealant. In application, zinc-dust particles are squeezed into the thread capillaries where they fix the more plastic lubricants in place.

TABLE 1—A.P.I. THREAD COMPOUND

Component—	Per cent by weight
Aluminum stearate	1.25
Process oil	19.21
Silicon compound*	12.85
Silicon fluid†	2.59
Graphite	18.00
Lead powder	30.50
Copper flake	3.30
Zinc dust	12.30

*XC-217 (7 per cent silica)—Dow Corning.
†XF-60—Dow Corning.

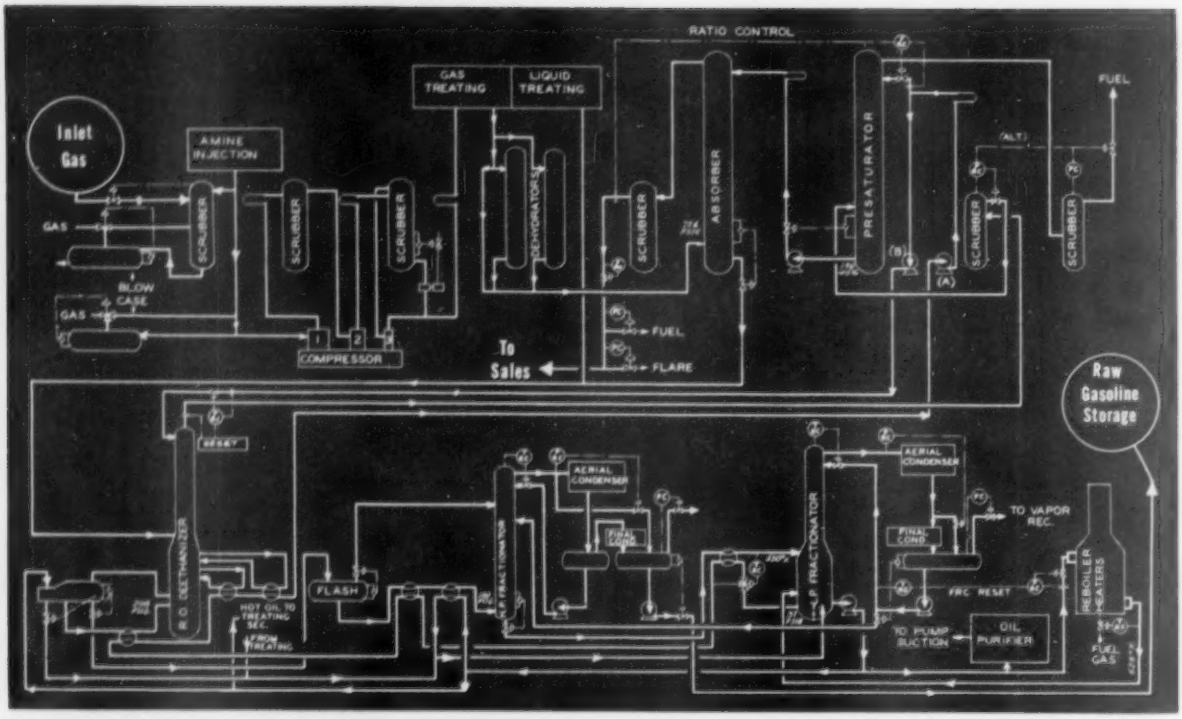
Experimental compounds not containing zinc, but with a higher content of lead powder, graphite, and copper flake show a tendency to leak when joint pressures of 10,000 psi. are applied. Joints made up with a compound containing zinc have remained free from leakage for nearly 4 months with a sustained high pressure. Aluminum is of little value because it opposes lubrication with no evident sealing value.

Other necessary agents . . . It should be noted that neither of the organic components nor the silicone fluids in the A.P.I. formula are included for lubricating action. Aluminum stearate dispersed in the process oil forms a gel to suspend the metallic particles during storage. The silicone fluids offer superior protection from corrosion.

The two silicone components, the process oil, and the aluminum stearate also function as dispersing mediums. They assist in breaking down aggregates of metal powders and effectively wet and hold the particles separate.

References

1. Mattiello, J. J., Protecting and Decorative Coatings, Vol. IV, p. 10.
2. Mayberry, M. G., "Development of an A.P.I. Thread Compound," Mellon Institute of Industrial Research.



SAUNDERS PLANT has increased gas-handling capacity from 22,000 to 36,000 M.s.c.f.d. Note use of two stills (low-pressure and high-pressure fractionators) and presaturator. Fig. 1.

Warren absorption plant employs

Dry Distillation, Two-Still System

Other features: presaturator, H_2S recorder, dew-point control, hydraulic turbine drives

by R. L. Lane
Warren Petroleum Corp.

WARREN PETROLEUM CORP.'S Saunders natural-gasoline plant in Lea County, New Mexico, serves seven small pools: Bagley, Hightower, Lazy J., Saunders, Townsend, Edison, and Shoe Bar. The plant handles a mixture of gas distillates and solution gas. Gas is sold to El Paso Natural Gas Co.

With the completion of the latest extension, the Saunders plant has increased its daily gas handling capacity from 22,000 M.s.c.f. to 36,000 M.s.c.f. A combination of features and practices, not found in other natural-gasoline plants, has been incorporated into these facilities.

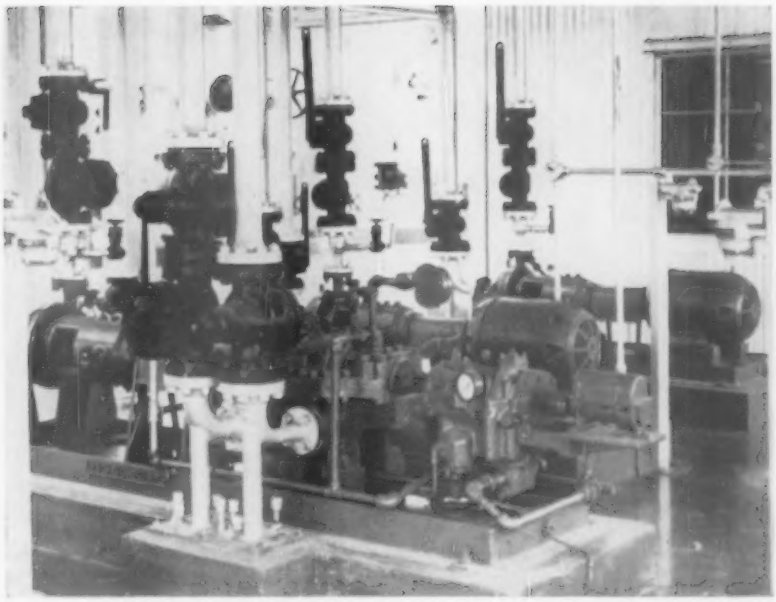
Dry distillation . . . This is now practiced at eight of Warren's plants. The Saunders plant is the latest to incorporate dry distillation. Warren's experience indicates that investment cost is only slightly higher than for a system employing steam stripping. Operating cost is definitely lower for the dry distillation systems and there are a number of other advantages.

Two-still plant . . . A high-pressure still (100-psig.) and a low-pressure still (57-psig.) are employed. Direct-fired heaters are used to reboil the low-pressure still bottoms. This stream is returned to the low-pressure still at a temperature of 625° F. This high temperature insures that heavy ends (C_6's and C_7's) will be stripped out and carried overhead in this still. The basic idea behind this two-still system is similar to that of the two-stage flash employed in refinery processing.

Presaturator . . . Residue gas from the rich-oil deethanizer is contacted with lean oil in the presaturator. Roughly 3,000 M.s.c.f.d. of gas is absorbed in the presaturator and pumped with the absorption oil to the main absorber. It is cheaper to pump the absorption oil with the components in it than to recompress the 3,000 M.s.c.f.d. of gas. The off-gas from the presaturator goes to plant fuel. This off-gas is less than that required for the plant fuel. The fuel needs are made up from the absorber residue gas.

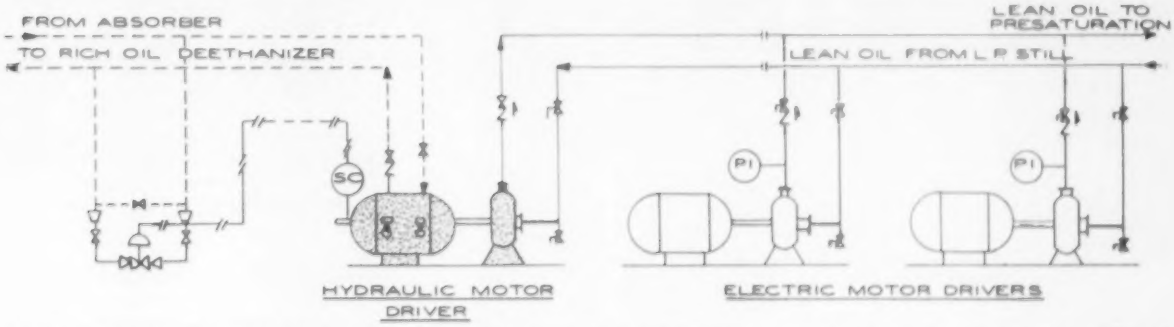
Hydraulic turbine drives . . . There are two interesting applications at the Saunders plant for energy recovery by "hydraulic turbine" drives. Energy which would ordinarily be wasted in a pressure letdown through a control valve is used to drive pumps. One of these is believed to be the largest (100-hp.) hydraulic-pump - and - motor

FIELD PROCESSING



A GENERATOR-TYPE tachometer (right foreground) is mounted on one end of hydraulic motor for speed control.

HYDRAULIC MOTOR SPEED is recorded and indicated here.



HYDRAULIC-MOTOR DRIVER installation. Method of obtaining speed control through pneumatic diaphragm valve in bypass is shown. Fig. 2.

unit in this type of application; the two units are also the first multistage hydraulic drives employed for this purpose.

Dew-point control . . . A modified Bureau of Mines apparatus is used to measure residue-gas dew point. Part of the gas coming from MEA treating is dehydrated; the remainder is bypassed around the dehydrators. Undehydrated gas is blended with dehydrated gas and dew point of the blended gas is measured. The dew-point measurement is tied in with a recording controller and the control valve is installed in the bypass around the dehydrators to regulate amount of bypass according to the residue-gas dew-point measurement.

H_2S recorder . . . An H_2S analyzer with recorder is located in the El Paso Natural Gas Co. booster station. A pneumatic transmitter is included in this installation. This works in conjunction with a receiver in the Warren control room where another H_2S recorder keeps tab on the H_2S content of the sales gas. An alarm is incorporated with the H_2S analyzer installation.

Oil reclaimer . . . This is of interest in that it is operated continuously with external reflux supplied to a ceramic-ring-packed upper section.

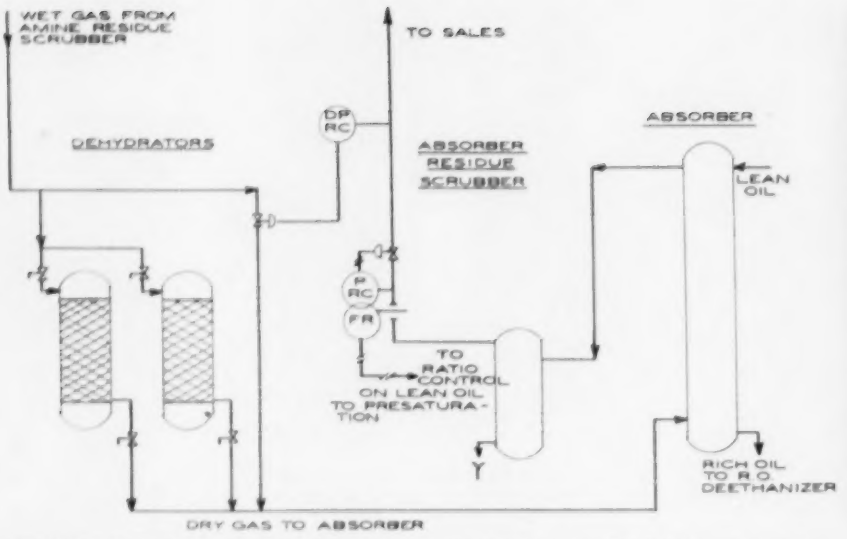
Shutdown system . . . An extensive and integrated automatic alarm and safety shutdown system has been designed and incorporated by Warren in the Saunders plant facilities.

What Price Spares?

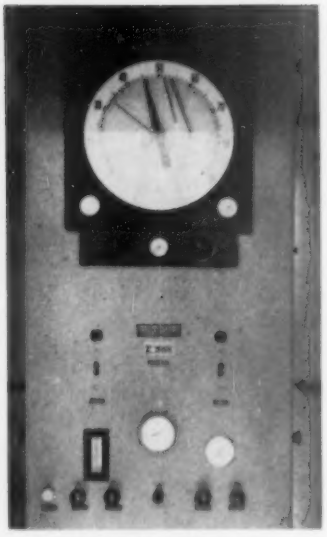
Two practices of interest were involved in engineering and purchase of equipment for the original plant and the extension. These were: (1) wherever possible 100 per cent standbys were provided on pumps, and (2) additional compressors for the extension were purchased on a volume delivered basis.

Spares . . . Attention has been called elsewhere[1] to the problem ordinarily faced by the engineer when specifying spare pumps, enchangers, or other equipment. In the case of Warren's Saunders plant the phrase, "What Price Spares,"[1] had a double significance. One consideration was the usual one of providing a standby to prevent shutdown in case of equipment failure. The other was to have available additional equipment which could be converted to full-time use to accommodate larger total plant capacity in a future expansion. By carrying out such a program, purchase of additional pumps, etc., was not necessary when the expansion actually took place.

Admittedly this complicates the problem of specifying space equipment. But in the interim between engineering and purchase for the original plant and the plant expansion, prices of equipment rose. The resultant savings certainly were worth the extra work and exercise of judgment involved in con-



DEW-POINT recording controller operates control valve in bypass around dehydrators in accordance with the dew point of residue gas. Fig. 3.



MODIFIED B.M. dew-point instrument with record and indication of moisture content of gas.

sidering future requirements when selecting spares for the original plant.

Other well-known practices were also employed. Smaller impellers with large casings were specified for centrifugal pumps so that these could be fitted with larger impellers at a future date. Control valves were equipped with undersized inner valves which could be changed to handle additional capacity of a future expansion.

Volume delivered basis . . . In making the current extension to 36,000 M.s.c.f.d., three additional compressors were added. There are now a total of eight 1,350-hp. supercharged compressors in operation. All of the compressors for the plant were not ordered in terms of horsepower. They were bought on a capacity guarantee—to handle a specified volume of gases at a specified pressure.

Saunders Process Cycle

Fig. 1 indicates the Saunders process cycle. Raw liquids extracted in the Saunders facilities are moved by pipeline 35 miles to the Monument plant for fractionation.

Typical inlet gas composition is:

Component	Mole per cent
CO_2	0.85
H_2S	0.14
N_2	0.62
C_1	71.91
C_2	11.06
C_3	8.05
$i\text{-}C_4$	1.17
C_4	3.27
$i\text{-}C_5$	0.77
C_5	0.95
C_6	0.98
C_7	0.23
Total	100.00

Gas treating . . . Amine solution is injected into the inlet-gas scrubber to help reduce corrosion in the compressor plant. Gas and scrubber condensate from the compressor plant go to the MEA plant. Originally the treating plant was a glycol-amine unit. However, in engineering the Saunders plant extension it was decided to convert to a straight MEA unit and solid-desiccant dehydrators. This was prompted largely by the need for greater capacity and increase in CO_2 content of the gas.

Gas and liquid material from the third-stage cooler, containing 0.89 grains of H_2S per 100 cu. ft., go through the amine gas feed scrubber. The gas is then contacted with MEA in the amine gas contactor. (Treating equipment is not shown in flow sheet.) The H_2S content is reduced to 0.25 grains per 100 cu. ft. or less and the gas then goes to the dehydrators.

Liquid from the amine gas contactor feed scrubber goes to an amine liquid contactor. After liquid-phase treating, this scrubber condensate leaves the MEA plant and is piped with the rich oil from the absorber to the rich-oil deethanizer.

Rich-oil deethanizer . . . Following dehydration and absorption, the rich oil from the absorber goes to the rich-oil deethanizer. It is desired to make a finished product (raw natural gasoline) in which the ethane content is held down to about 2 per cent of the propane content.

Presaturator . . . The rich-oil deethanizer residue gas goes to the presaturator. Here the lean oil is presaturated with methane, ethane, and propane. In tying together the functions of the main absorber, presaturator and rich-oil deethanizer in the process cycle, two flow ratio control systems are employed. In one of these the flow of lean oil to the presaturator is controlled according to the amount of main absorber residue gas. In the other ratio system, the flow of lean oil to the rich-oil deethanizer is controlled in accordance with amount of rich-oil deethanizer residue gas going to the presaturator.

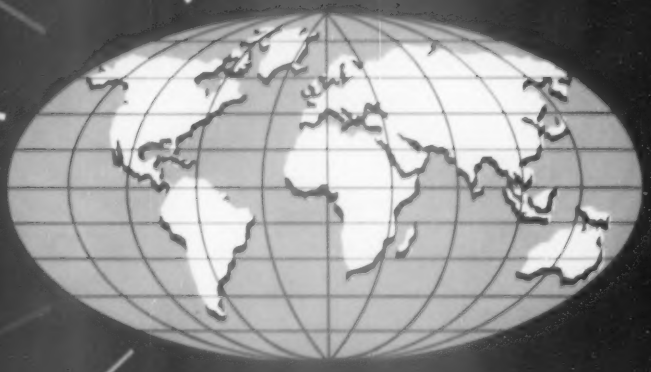
Heat for stripping in the lower section of the rich-oil deethanizer is provided by hot lean oil returning from the still system and by hot oil heating of the rich-oil deethanizer reboiler. Rich-oil deethanizer bottom product is flashed at 130 psig. and heated before entering the high-pressure rich-oil fractionator (high-pressure still).

Two-still system . . . Operation of the two-stage still system is indicated, in general, in the Fig. 1 flow sheet. The rich oil is heated to 500° F. and the

THE AUTHOR

R. L. Lane is chief engineer for Warren Petroleum Corp. He attended Georgia Tech in M.E. curriculum. He was assistant chief engineer in the gas-gasoline department of Sinclair Refining Co. in the Tulsa office over a period of 14 years. Lane was chief construction engineer with Chemical Construction Co. on the Cactus Ordnance plant before coming with Warren in his present position in 1943.

Where in the World does Drilling Mud come from?



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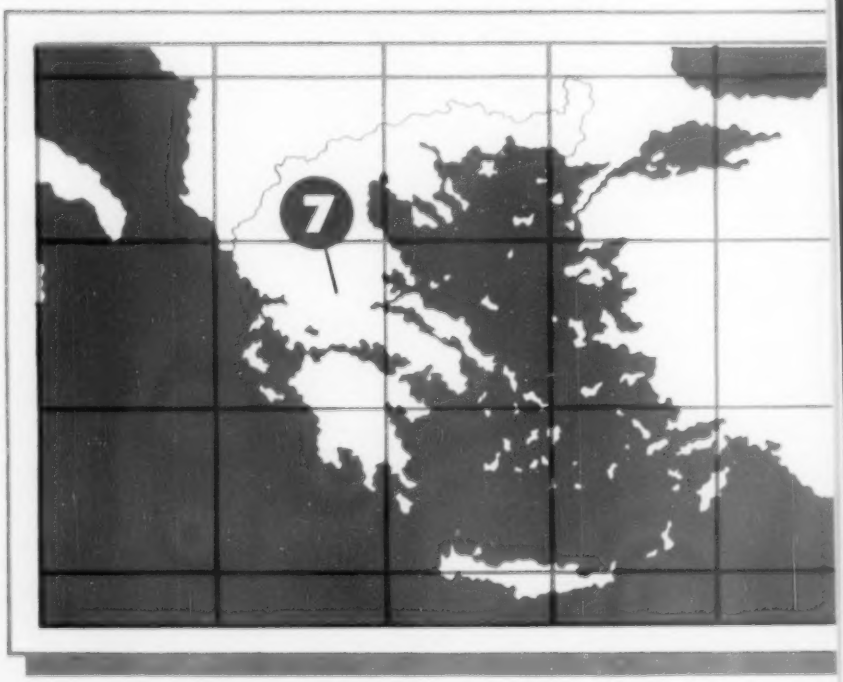
7. *Greece*
8. *Mexico*
9. *Hinson, Florida*

MILLS:

Malvern, Arkansas (barite)
Greybull, Wyoming (bentonite)
Brownsville, Texas (barite)
New Orleans, Louisiana (barite)
Lake Charles, Louisiana (barite)
Zavalla, Texas (clay)
Battle Mountain, Nevada (barite)
Hinson, Florida (clay)



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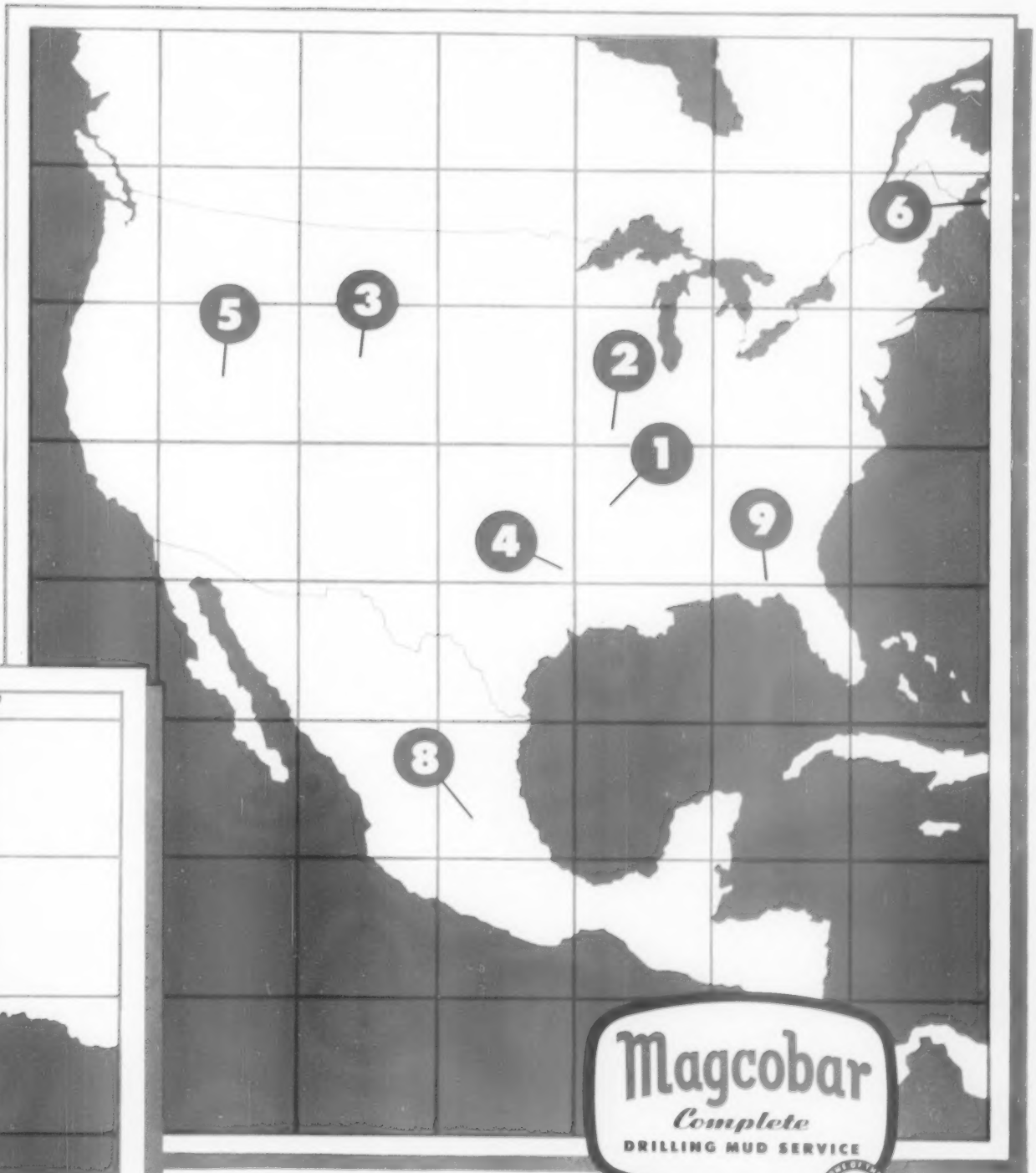

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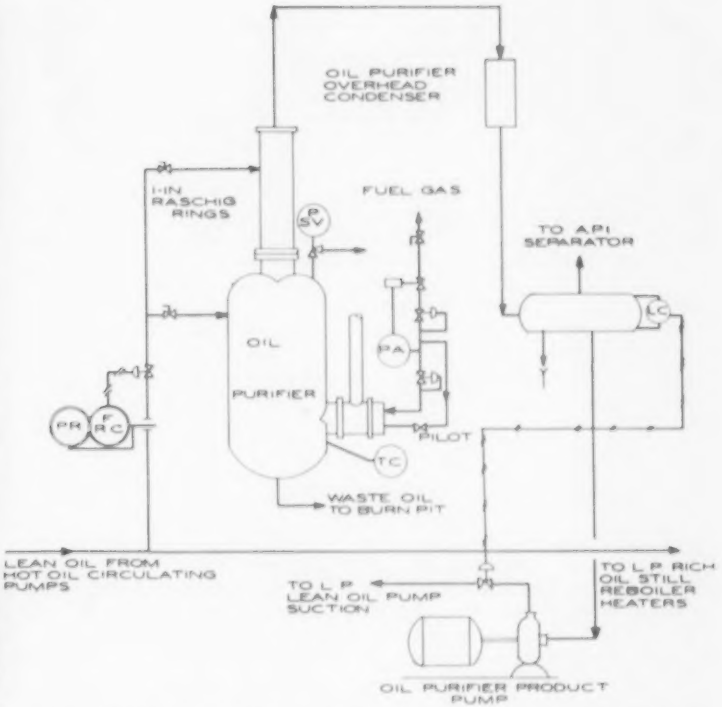
OIL PURIFIER in foreground slightly to left was made from standard oil-field heater.



A SMALL AMOUNT of lean oil is refluxed over the upper packed section (1-in. ceramic rings) of the oil reclaimer. This helps to stabilize the absorption oil. Fig. 4.

vapors are fractionated overhead in the high-pressure still. This may be thought of as a rectified flash—a light-ends flash with light natural gasoline going overhead.

The reduced rich oil leaves the base of the high-pressure rich-oil fractionator, is heated, and goes into the low-pressure still. Here the second stage of the rectified flash process takes place—stripping is completed in the low-pressure still with the heavier ends taken overhead. A portion of the low-pressure still overhead liquid is returned as reflux to the low-pressure and also to the high-pressure still to aid the rectification process.

Dry distillation . . . Oil from the base of the low-pressure still goes through the reboiler heaters, being raised here to a temperature of about 625° F. This is much higher than temperatures normally encountered in natural-gasoline processing, but sufficiently below cracking temperature. The idea, in this particular phase of Saunders processing, is to vaporize some 40 per cent of the oil in these heaters. The vapors so provided are returned to the still to do the stripping job. The high temperature level at which this operation is conducted insures that the heavy ends will be taken overhead completely in the low-pressure still. (Editor's note: For more on dry distillation, see article by Lane and Thompson.[2])

Hot-oil heating . . . A portion of the hot oil from the base of the low-pressure still is withdrawn for use as heating medium. Note also instrument interlock between flow-recording controller on oil to reboiler heater and temperature-recording controller on hot oil leaving base of low-pressure still.

Watch the absorption oil . . . In the still system just described it is very important to watch the absorption-oil distillation curve. Do not select a wide-boiling absorption oil with relatively flat A.S.T.M. distillation curve through the midpoint. With such an absorption oil, the control of the operation will be difficult since a shift of just a few degrees in temperature will result in a disproportionately large increase in vaporization. With too much vaporization, heater temperature will consequently be too low. There will be difficulty in attaining the design temperature. For this reason a relatively narrow-boiling absorption oil is preferable in this case.

Lean-oil surge . . . Another feature of the still system is that a lean-oil surge is provided in the base of the low-pressure still. A vertical partition is provided as indicated. If the pump should be out of service, all the oil can be withdrawn on the opposite side of the partition.

No process steam whatever is employed in the plant. One small (60-hp.) oil-field boiler is used to make steam for cleaning or steaming-out purposes. Water is obtained from wells and is treated. Aerial cooling is employed as much as possible. Warren has its own power-generating plant at Saunders.

More on Special Features

The use of a hydraulic-motor-and-pump unit at Warren's Ringwood, Okla., plant has been described.[3] In the Saunders plant, two such units are used. They are of particular interest since the hydraulic turbine or motor is: (1) a different type from that used at Ringwood, (2) one of the installations at Saunders is believed to be the largest in this type of application, and (3) this installation also employs the first multistage hydraulic motors ever used in such application.

Hydraulic-motor drive . . . Fig. 2 shows one of these unit installations. It is on one of the three low-pressure lean-oil pumps, designated by the letter (A) in the flow sheet of Fig. 1. These pumps handle lean oil through the final coolers to the presaturator. The lean oil is pumped by one electric-motor-driven pump and one hydraulic-motor-driven pump. The third pump, driven by electric motor, is employed as standby.

These are 100-hp. pumps. The energy for the hydraulic motor is derived from the pressure letdown between the main

absorber and the rich-oil deethanizer. It will be noted from Fig. 1 that this pressure drop is one of about 550 psig. Therefore, this stream is logically employed as the driving medium here.

The second installation (in which one of three pumps is again driven by hydraulic motor) is that of the rich oil deethanizer-lean oil booster pumps designated by the letter (B) in flow sheet, Fig. 1. This installation is arranged just like that shown in Fig. 2. However, this is a smaller (20-hp.) hydraulic motor. In this case the driving medium is the rich amine stream from the bottom of the amine gas contactor in the treating section. This stream comes down in pressure from around 775 psig. in the amine contactor, through the hydraulic motor, down to nearly atmospheric pressure in the amine exchanger just before entering amine still.

Diffuser type . . . The hydraulic turbine or motor drivers used in these two applications at Saunders are 3,550-r.p.m. double-end-shaft, split-case centrifugal units. They are equipped with high-pressure, balanced mechanical seals. They are multistage (three-stage) units of the diffuser type — equipped with equally spaced guide vanes. Other centrifugal hydraulic turbine drivers of the volute (single-stage) type are in use elsewhere in non-Warren field processing plants. The hydraulic-motor drivers mentioned in application at Warren's Ringwood plant are of the rotary type.

How speed control works . . . At the Saunders plant, the two hydraulic turbines are speed controlled. It will be noted in Fig. 1 that discharge of both the lean-oil pumps and the rich oil deethanizer-lean oil booster pumps are throttled under flow control. In order to get the proper pump discharge head at varying deliveries as dictated by the flow controllers, the speed of the hydraulic turbine driver must be kept constant at or close to 3,550 r.p.m. A generator-type tachometer is used on one end of the hydraulic motor to govern the speed as indicated in Fig. 2. In this arrangement it is possible to hold the speed constant by actuating the control valve in the bypass to divert more or less of the driving medium from the hydraulic motor. This is done through an electropneumatic controller mounted in the control room, with both record and indication of the r.p.m. on the board.

Dew-point controller . . . Alternate methods might be employed to control dehydrator operation. In one method the whole wet-gas stream is passed through the dehydrator. A dew-point recording controller on the dehydrator outlet can be used to regulate the drying cycle in accordance with the load. Another method is to bypass some of the undehydrated gas around the dryer and blend it with the dehydrated portion.[4] This method is used by Warren at the Saunders plant and is indicated in Fig. 3.

The dew-point recording controller operates the control valve in the bypass to admit more or less wet gas around the dehydrator according to the dew-point measurement of residue gas. A Bureau of Mines dew-point-type instrument is used. This measures moisture content of gas through absorption of moisture by lithium chloride and measurement of the resistance of the lithium chloride under line conditions.

A standard pneumatic recording controller (with proportional band) was modified for this service. It has been provided with special pressurized, fireproof mounting. The instrument is also provided with alarm switch. Residue gas is ordinarily sampled automatically each 30 minutes. Should the moisture content exceed the prescribed 7 lb. of water per M.M.c.f. of gas, the horn alarm will sound. Samples will then be taken every 15 minutes until the moisture content has been reduced to the proper level through regulation of the amount of bypass around the dehydrator.

Since the Saunders plant employs a dry distillation system, a dew-point depression of 5°-7° F. is obtained in passing through the absorber. The dew-point measurement is therefore located on the residue gas line.

H_2S analyzer-recorder . . . To monitor H_2S concentration an analyzer is used with an electronic potentiometer recorder. The analyzer employs a white cloth tape impregnated with lead acetate. This turns to brown lead sulfide on exposure to H_2S. Light reflection from this tape (as compared with that reflected from a nonimpregnated tape) is measured by two photoelectric cells in a bridge-type circuit.

This standard instrument has been incorporated in the pneumatic receiver-transmitter system between the Saunders plant and the adjoining El Paso meter station. The H_2S analyzer-recorder is located in the El Paso booster station, with a transmitter to a recorder which is located in the main control room. The pneumatic transmitter-receiver system was added to provide Warren with a record of H_2S content of treated gas while complying with requirement for explosionproof instruments in the main control room.

The analyzer has an automatic alarm contact set at 0.25 grains per 100 cu. ft. of gas (approximately four parts of H_2S per million parts of gas). The chart range is from zero to 0.5 grains, direct reading.

El Paso Natural Gas Co. has used a number of these analyzers in stations where treated gas is purchased in large volume, and in several of its own stations. Other types of instruments have also been used by El Paso for monitoring H_2S content of gas, including a brand-name instrument and an automatic H_2S detector of El Paso's own design. The usual hand lead acetate tests and chemical analyses have also been used.

Oil purifier . . . Operation of the oil reclaimer at Saunders plant is indicated in Fig. 4. A standard oil-field heater is used as the purifier. While the principle employed here is certainly an old one in refinery processing, its application in this case is of interest since refluxing of a little oil over the ceramic-ring-packed section helps to stabilize the absorption oil.

Safety shutdown . . . Automatic shutdown for the rich-oil heaters and a high-level alarm and emergency shutdown system for the compressor and process areas are provided.

Engineering on the original Saunders facilities was done by Warren and Fluor Corp., Ltd., with Fluor doing the construction work. The labor contract on the Saunders extension was held by Dresser Engineering Co.

Acknowledgment

Appreciation is expressed to K. H. Bacon, of Warren Petroleum Corp., and Kenneth Ruhl, of El Paso Natural Gas Co., for aid given on portions of this article.

Equipment

Compressors—Cooper-Bessemer Corp.

Instruments — Minneapolis-Honeywell Regulator Co.

Hydraulic turbine drivers — Pacific Pumps, Inc.

Dew-point controller—Chandler Engineering Co.

Hydrogen sulfide analyzer—Rubicon.

Oil purifier—Black, Sivalls & Bryson.

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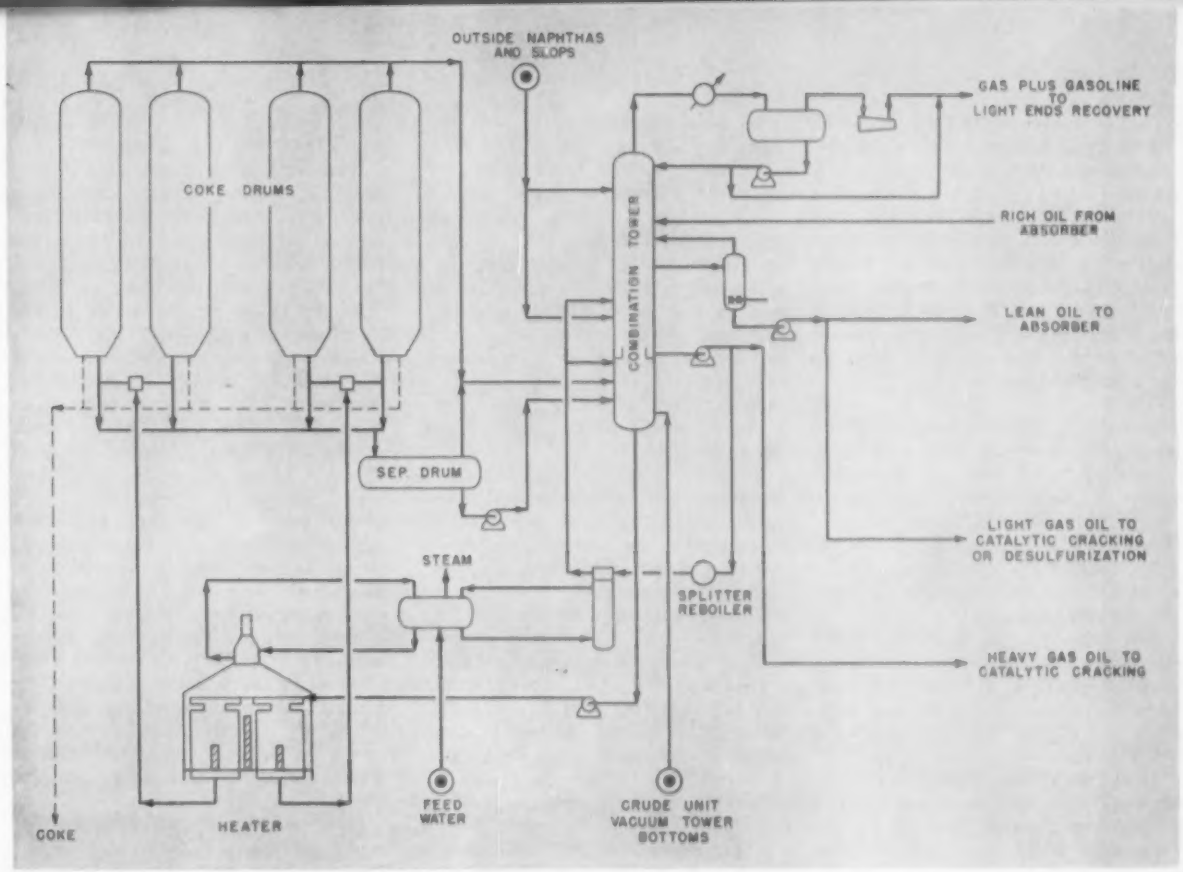

YORKTOWN COKER, American Oil Co. This unit is designed to charge the most highly reduced crude ever charged to a delayed coker. Fig. 1.

DELAYED COKING . . .

. . . a modern process 25 years old

by John E. Kasch* and E. W. Thiele†

JUST 25 years ago—in August 1930—the first commercial delayed coker began operations at the Whiting refinery of Standard Oil Co. (Ind.). Today, delayed coking is by far the predominant coking process.

It seems appropriate to review the inception and growth of the delayed-coking process, and to describe a modern installation—the recently announced 10,000-bbl. unit of American Oil Co. at its new Yorktown, Va., refinery.

Development of Process

In the delayed-coking process, heavy residuum is pumped through a tube heater into an insulated drum, which it enters at such a temperature that it destructively distills entirely by its contained heat, leaving only a coke residue, which gradually fills the drum.

Several drums are used to make the process continuous, they are filled and emptied in turn. The name "delayed" coking comes from the fact that sufficient heat is introduced in the tubes for complete destructive distillation, but the reduction to coke does not occur until after the residuum enters the drum.

The process originated in a deliberate attempt to satisfy a need. The technical force of Indiana Standard decided that the traditional shell-still coking process, with its high labor, fuel, and repair costs, must go. Ideas solicited from members of the staff were screened. The delayed-coking concept was selected for development. This concept was due to Dr. Robert E. Wilson, then assistant director of research, now chairman of the board of directors.

No pilot plant . . . The development of the process was unusual in that there was no small-scale work, not even a pilot plant. Calculation showed that residuum heated to about 910° F. and introduced into a large preheated drum would destructively distill and leave a coke residue. The main question to be settled was whether this temperature could be attained in a heating coil of commercial size without depositing excessive coke in the coil. The density and other qualities of the resulting coke also had to be established.

Accordingly, work was immediately started on a unit with a single coke drum, with a design capacity of 20 bbl. per hour. Much of the equipment was secondhand. Burton cracking stills, then going out of use, provided condensers, product tanks, a coke drum, and even a furnace shell.

One or two runs of the unit showed that acceptable coke could be produced, and that the heater tubes would remain clear for some days. To demonstrate that runs of commercial length could be made without excessive coil

Authors are with *American Oil Co. and †Standard Oil Co. (Ind.).

coking, the oven drum was bypassed, and the residuum was heated to the desired temperature and immediately cooled.

The method of removing the coke from the drums was given much attention. Some experiments were even made with dynamite. The method eventually chosen was to wind a cable in the drum before filling and afterward withdraw it with a winch, to break up the coke bed into lumps.

First unit . . . The first commercial delayed coker was also built at Whiting. Known as No. 7 pipe still, it was designed to charge 2,400 bbl. per day of 20 per cent Mid-Continent residuum. It started operation about August 15, 1930. From there, it worked excellently, except that the coke-removal facilities were inadequate.

The cable was too small, the winch too weak, and the method of winding incorrect. It took an entire winter to work out these difficulties, but thereafter No. 7 pipe still became a reliable refinery unit.

Launched at the beginning of a depression, the delayed-coking process was slow in extending itself. It was for some time confined to the refineries of the originating company. Gradually, it was taken up by others.

Two steps in the evolution of the oil industry speeded the adoption of delayed coking; the development of catalytic cracking made gas oil more valuable, and the dieselization of the railroads forced refiners to find new outlets for residual fuel. To date, some 20 units with a combined capacity of over 300,000 bbl. per day have been erected in the United States alone.

The original unit is still in use; it is regarded as marginal equipment, primarily because of its small size. The only major change in the later units has been the introduction of hydraulic decoking—a contribution of the Shell organization.

The Yorktown Delayed Coker

An excellent example of the present state of the art of delayed coking is the Yorktown unit, for which American Oil Co. has recently awarded a contract to Lummus Co. It is now in the design stage, with construction scheduled to start this fall and completion next year.

Feed . . . An economic evaluation usually shows that the maximum return is obtained by coking the heaviest possible reduced crude. This is the case at Yorktown. In fact, this coker is being designed to charge the most highly reduced crude ever charged to a delayed-coking unit. The charge stock at Yorktown will be an asphaltic pitch with a softening point (B and R) of 138° F., a penetration (77°F) of 30, a viscosity (Saybolt Furol at 210° F.) of 6,000 seconds, a gravity of 6.1° A.P.I., and a Conradson carbon content of 25 weight per cent.

It will contain 3.1 per cent sulfur and about 0.11 per cent vanadium. The highest Conradson carbon content of any feed currently processed in a delayed coker is believed to be about 15 per cent, and the heaviest feed processed commercially is thought to be a vacuum reduced crude of about 75° F. softening point.

Products . . . Fractionation and absorption equipment will be provided. The products and their disposition will be:

Dry gas—to fuel.

Propane and butane—to the catalytic cracking unit for recovery and treating.

Light gasoline—to a treating unit.

Heavy naphtha—to the hydrofining and Ultraforming unit.

Light gas oil—to catalytic cracking, or to be hydrofining for burning oil or diesel fuel.

Heavy gas oil—to catalytic cracking.

Coke—to be sold for boiler fuel.

As an example of the expected yields, Table 1 presents, based on pilot-plant operations, a material balance for coking, with 15 per cent recycle, an 80 penetration, 21 per cent Conradson carbon, 7.7° A.P.I. vacuum reduced crude.

Equipment and flow . . . Fig. 1 gives a simplified flow diagram of the unit. It consists essentially of a heater, four coke drums, and a fractionating tower. The latter can receive several feed streams and produces several products, and is therefore called a combination tower. There is also equipment (not shown in the figure) for separating gas and gasoline into components.

The primary design calls for a fresh feed rate of 8,200 bbl. per stream day, which is to be mixed with 15 per cent of recycled heavy coker gas oil, with a true boiling point above 850° F.

For operating flexibility, the design will permit the charging of a lighter reduced crude at about 10,000 bbl. per stream day. The recycle rate may go as high as 40 per cent, and the total furnace charge may vary between 7,000 and 13,000 bbl. per stream day.

TABLE 1—PILOT-PLANT PRODUCTS

	Vol. %	Wt. %	°A.P.I.
C_3 and lighter		7.9	
C_4	3.8	2.2	
C_5-400° F. A.S.T.M.	23.9	17.9	60.5
400°-650° F. A.S.T.M.	23.0	19.4	33.1
650°-950° F. A.S.T.M.	18.6	17.0	21.0
Recycle	15.0	14.3	15.0
Coke		35.6	
		114.3	

The fresh feed enters at 500° F. near the bottom of the combination tower and mixes with the tower bottoms. The combined feed enters the heater, which is entirely gas fired, and has a duty of 58 million B.t.u. per hour.

In the design of the heater special attention was paid to heat distribution, which is essential to avoid excessive coking in the tubes. The heater discharges the feed in parallel streams at about 920° F. to two of the four coke drums. The gage pressure in these drums is 25 psi.

Drum cycle . . . Each drum will be on stream 24 hours at a time, and off stream 24 hours, while it is cooled with steam and water, decoked by a stream of high-pressure water, and reheated.

Vapors from the drum on stream reach the combination tower directly and, during the reheat step, also via the separator drum. Condensate from this drum also enters the combination tower. In addition, any outside charge material can be introduced into the tower at appropriate points.

Side streams from the tower are heavy gas oil and light gas oil; the latter is stripped with open steam. The tower overhead is of gasoline end point and includes the gas. It is cooled, reflux is returned, and the net gas and liquid pass to equipment not shown, namely, an absorber, a gasoline stripper, a debutanizer, and a gasoline splitter (to produce light gasoline and heavy naphtha).

Heat is withdrawn from the combination tower by utilizing a circulating heavy gas-oil stream to furnish heat to the gasoline splitter, and to make steam.

Conclusion

Twenty-five years is a venerable age for a petroleum refining process, but the delayed-coking process is still alive and vigorous. As the second quarter-century starts, plans for additional units are being announced, and the process is to be extended to a novel feed stock—Utah gilsonite.

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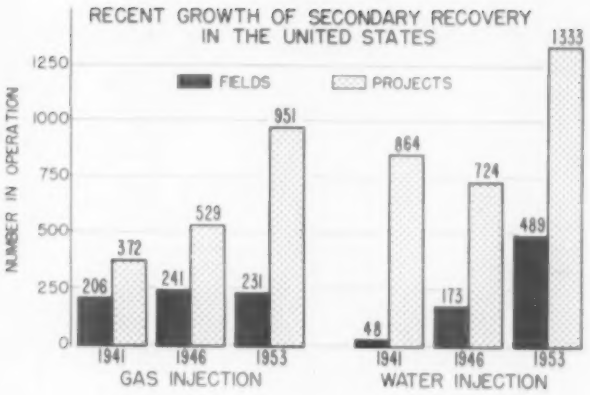
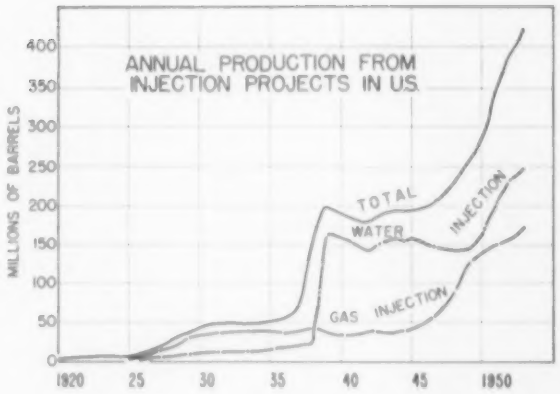
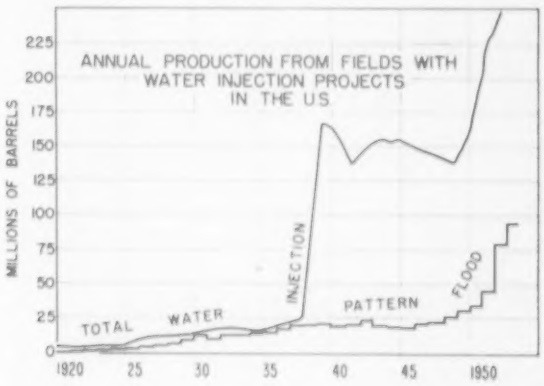






Second Recovery in U. S. and Canada

Fifth of U. S. Oil From Fields Operating Injection Projects

by Lewis Finch, Jr., and F. M. Stewart

SECONDARY recovery involves the injection of water or gas to supplement natural energy, thereby increasing recovery over that obtainable by primary operation alone. In many cases ultimate recovery with secondary methods is 1.2 to 2.0 times the expected primary recovery. The type of program adaptable to a field depends on its primary performance and certain reservoir characteristics.

Authors are chief engineer and staff petroleum engineer, respectively, producing department, Stanolind Oil & Gas Co. Paper presented at 1955 western meeting of petroleum and natural-gas division, Canadian Institute of Mining and Metallurgy, Edmonton, Alta.

. . . **In the United States,** application of secondary-recovery methods is becoming increasingly important. About 22 per cent of United States oil production now comes from fields in which injection projects are operating. In 1953 nearly 1.4 million barrels daily came from such fields, more than double the amount of the early 1940's.

. . . **In Canada,** secondary recovery has not been so widespread mainly because the D-3 reef reservoirs, which have held the major reserves, are under water drive. However, appreciable amounts of water are being injected in the Redwater D-3, Leduc D-2, and Joarcam Viking reservoirs, and gas in the Golden Spike D-3.

In both countries, possible achievements in increased recovery through

PRODUCING

CRUDE-OIL RECOVERY AND PRODUCTION
(Billions of barrels)

	Total U. S.	Units
Original oil in place	±272	18.6
Produced to 12-31-54	49.9	3.3
Reserves to 12-31-54	29.6	5.3
Ultimate recovery	79.5	8.6
Primary recovery	73.0-75.0	5.1
Increase by secondary recovery	5.0-7.0	3.5
Increase by secondary recovery, per cent	7-10	70
Total production 1953	2.34	
Production from secondary recovery fields	0.42	(0.21)
Production from secondary recovery fields, per cent	18	

SECONDARY VS. PRIMARY RECOVERY
(Per cent of oil or condensate in place)

Primary drive—Secondary method—	Recovery range—Primary	Recovery range—secondary	Typical recovery—Primary	Typical recovery—secondary	% incr.	Example*
Dissolved gas:						
Dispersed gas injection	12-28	16-35	21	27	30	N. Cowden
Pattern water injection	12-28	25-70	21	42	100	Ceres
Edgewater injection	12-28	25-70	21	42	100	N E. Jones
Gas cap:						
Gas cap injection w./gr. dr.	30-70	40-80	50	65	30	Elk Basin
Gas cap injection	15-45	20-60	30	36	20	Fairbanks
Edgewater and gas cap	15-45	25-60	20	35	75	Haynesville
Water drive:						
Edgewater injection	25-80	40-80	60	70	15	E. Texas

*Recovery not necessarily typical

both secondary-recovery methods now in use and new ones which may be developed through research and field trial are a challenge to the scientist and the industry.

Recoverable oil . . . Ultimate primary recovery from known pools in the United States is estimated at roughly 73 billion barrels. Secondary-recovery projects already in operation will increase this to almost 80 billion, an increase of almost 10 per cent.

Unitized secondary-recovery projects have been very successful. From unitized projects alone, industry reserves in the United States have been increased by 3½ billion barrels.

The total future **proved oil reserves** in the United States, however, including that recoverable by natural means and from secondary-recovery projects already in operation, is 29.6 billion barrels. In contrast to this oil reserve, it has been estimated that almost 200 billion barrels† will be left in the ground if it is not recovered by secondary means or by new and as yet undiscovered methods.

Unrecoverable oil . . . However, a large part of such oil is not physically recoverable by any method known. Many fields are produced efficiently by primary. Some fields are simply not suitable for secondary recovery by processes in use today. In addition, much of the remaining oil could not be recovered economically even if secondary recovery were workable in all pools.

Although only a fraction of such oil can be recovered by present methods of recovery, it offers a formidable challenge to petroleum technologists. The type of project adaptable to a particular field depends on the primary drive, rock and fluid characteristics, oil, gas, and water saturation.

†I.O.C.C. data source (see The Oil and Gas Journal, June 27, 1955).

Each prospect must be carefully studied to evaluate probable success and select the most favorable program.

. . . Secondary recovery is becoming increasingly important to the industry because of the difficulty in finding new oil reserves. In 1954 in the United States, 11,280 wildcat wells were drilled compared to 4,256 in 1945. Last year, 586 million barrels reserves were added through new discoveries. This is 11 bbl. per foot of wildcat hole drilled. In 1945, 420 million barrels reserves were discovered, which is 25 bbl. per foot of wildcat hole drilled, over twice that of last year.

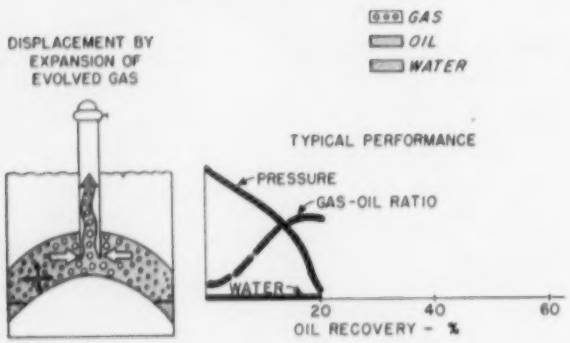
Acknowledgment

Appreciation is expressed to A. E. Sweeney, Jr., of the Interstate Oil Compact Commission for certain data on secondary recovery in the United States, and to the management of Stanolind Oil & Gas Co. for permission to prepare this paper.

How Oil Is Recovered

1. Primary Methods

DISSOLVED GAS DRIVE



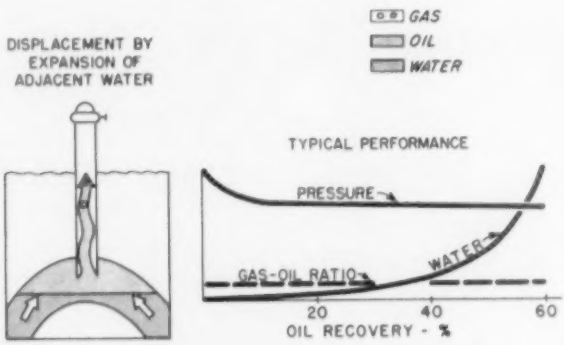
Dissolved Gas Drive

1. Reservoir oils contain various amounts of dissolved gas at original pressure. When pressure is released oil flows to the producing well because of the pressure gradient created. As oil is withdrawn and pressure in the reservoir decreases, gas comes out of solution and expands to occupy space voided by oil. With continued production, reservoir pressure progressively drops and additional gas is released displacing oil toward the wells. The released gas occupies more and more of the pore space until gas also begins to flow.

As pressure drops further, more gas is released, gas flows in increasing amounts displacing additional oil, oil saturation decreases, and the rate at which oil is moved to wells for a given pressure gradient becomes less.

The fraction of oil recoverable by dissolved-gas drive depends largely on reservoir rock and fluid properties. Recovery is affected very little by producing rate or well spacing. Oil recovery by dissolved gas drive is low, being generally only 12 to 28 per cent of oil originally in place.

WATER DRIVE



Water Drive

2. Water drive is the displacement of oil and gas by the expansion of water immediately adjacent to the oil zone. Water moves in response to lowering pool pressure by production. As production continues, pressure is lowered in the adjacent water body, the water expands and invades the oil zone. Since water is only slightly compressible, there must be an enormous amount in communication with the oil zone to give an effective water drive. Pressure in the oil zone tends to be maintained by the invading water.

Withdrawals from the higher part of the pool are replenished by oil displaced ahead of the water. Due to the buoyancy effect, oil tends to remain on top. This segregation helps in producing clean oil for a longer period of time from the higher wells. Some oil is moved by the invading water in a piston-like action; but after water breaks into a pore space, additional oil is removed by flow along with the water. After breakthrough of water into a producing well, the water-oil ratio continuously increases until the well can no longer be economically produced. Because there is little decline in pressure, little if any gas is released in the reservoir, and gas-oil ratio produced is the solution ratio.

In the water drive, it is not the dissipation of pressure that determines recovery but the depletion of the oil con-

tent of the rock pores by invading water until oil ceases to flow at economical rates. Recovery efficiency depends on the portion of the oil zone contacted by water, the effectiveness of the water in displacing oil from the flooded section, and the limiting water-oil ratio. The usual range for recovery by natural water drive is from 25 to 80 per cent of the oil in place. Typical recovery is 60 per cent.

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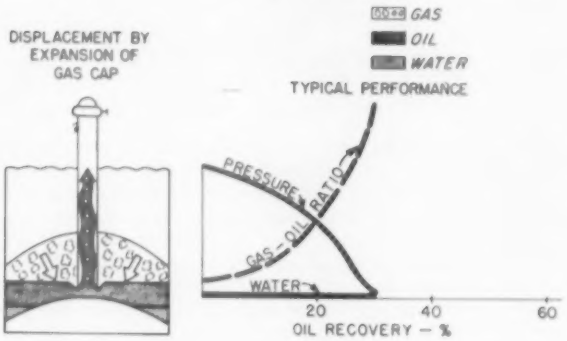
GAS CAP DRIVE



Gas-Cap Drive

3. In the gas-cap drive, oil is displaced by the expansion of gas from a gas cap. The gas cap may be made up of free gas initially present or released solution gas which migrated upward. In order to displace oil, the gas cap must expand downward at the expense of the oil zone. This expansion can occur only if there is a decline in pressure in the oil zone. As in the other type drives, pressure reduction occurs as a result of producing a reservoir.

As pressure drops, the gas cap expands downward acting like an inefficient piston; instead of cleanly displacing much of the oil, the invading gas, being highly mobile, tends to flow along with the oil. On breakthrough to producing wells, gas-oil ratio increases quickly. Oil rate and pressure fall off rapidly. The process continues until the supply of gas is exhausted, and pressure is so low that oil rate becomes uneconomic.

With only moderate gravity segregation effect, gas-cap drive is usually less efficient than water drive. This is because of the high mobility of gas compared to oil and the tendency of gas to move through the formation readily without displacing much oil. Recovery efficiency depends on the effectiveness of gas in flushing the oil space contacted; the portion of the oil zone finally invaded by the gas cap; the conservation of gas cap was by selective production of oil; the number of volumes of gas which go through the oil pore space; and the limiting gas-oil ratio. Recovery from gas-cap-drive reservoirs with only moderate benefits from gravity range from 15 to 45 per cent, with typical recovery being about 30 per cent.

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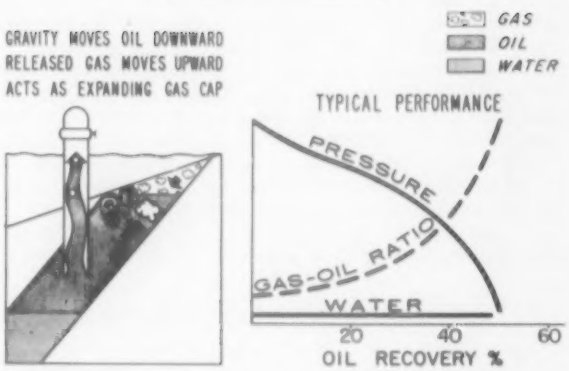
Gravity Segregation

4. Gravity segregation may be placed in a class by itself as a driving force; however, it is present to some degree with all expansion-type drives and tends to modify them. Gravity segregation is the buoyancy effect by which gas, oil, and water tend to seek their own levels according to their densities. It can play an important part in efficient oil recovery. If rock strata are inclined at a fair angle and appreciable oil height is involved, gas released

GRAVITY DRAINAGE

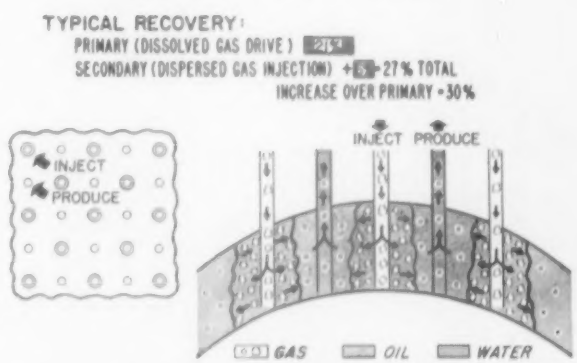


from solution should readily move upward forming a gas cap or enlarging one already existing. Oil may be selectively produced from lower wells. Efficient displacement by the invading gas cap occurs because the tendency for gas to break through is materially lessened.

With appreciable gravity effects, pressure declines slowly, provided wells invaded by the gas cap are shut in to conserve gas. Once gas breaks through to the lower wells and oil can no longer be selectively produced, pressure and rate fall off rapidly and gas-oil ratio increases as in the regular gas cap drive. With effective gas cap and gravity drive, recovery may range from 30 to 70 per cent, 50 per cent being typical. (However, proper conservation of gas-cap gas and selective oil production can hardly be practiced under competitive primary operation; therefore, actual recovery efficiency may be somewhat less.)

2. Secondary Methods

DISPERSED GAS INJECTION



Dispersed Gas Injection

1. Dispersed gas injection is the injection of gas through wells on a more or less uniform pattern. In many cases, produced gas is simply gathered, compressed, and injected. If there is not enough produced gas to maintain a desired pressure trend, additional gas may be procurred.

The injection of gas increases pressure over what it would otherwise be and displaces oil to low-pressure areas, the producing wells. Injected gas under favorable conditions will push some oil ahead of it in a bank. Behind the bank, additional oil is removed, flowing along with the gas. The process is the same as in the primary gas-cap drive, except in a horizontal rather than a vertical direction and thus without beneficial gravity effects. Under

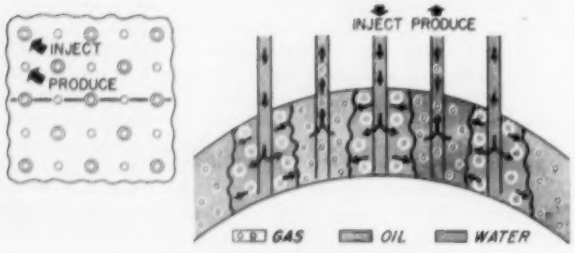
other conditions, gas may occupy so much of the pore space to start with that an oil bank cannot be formed; however, some additional recovery may still be obtained by oil flowing along with the gas.

After gas breaks through to the producing wells, gas-oil ratio continually increases. Unless the rate of injection is progressively increased, oil production declines. Operations are suspended when the cost of injecting gas and producing the oil can no longer be sustained by the oil production. Ultimate recovery from dispersed gas injection in a dissolved gas drive field may range from 16 to 35 per cent. Typical recovery is 27 per cent, 30 per cent greater than primary.

●

PATTERN (FIVE SPOT) WATER FLOOD

TYPICAL RECOVERY:
PRIMARY (DISSOLVED GAS DRIVE) 21%
SECONDARY (PATTERN FLOOD) + 21% = 42% TOTAL
INCREASE OVER PRIMARY = 100%



Pattern Water Flood

2. Water injected in a uniform pattern is called pattern water injection or water flood. Usually, the pattern is a "five spot," having one producing well for each injection well. Displacement of oil by injected water occurs no differently than in primary water drive. However, pattern flooding is usually restricted to essentially horizontal movement of oil.

Injection of water creates a pressure gradient toward the producing wells. The displaced oil locally increases oil saturation to form a bank or zone of high oil saturation. When this bank of oil reaches the producing wells, oil production goes up. As in the case of the natural water drive, water production occurs when water breaks through to producing wells; water-oil ratio increases thereafter. Flooding is suspended when the cost of injecting water and producing oil exceed the income from the declining oil production.

Pattern floods are particularly adaptable to nearly depleted, shallow, dissolved-gas-drive fields. Chances of success may be evaluated by a pilot project involving only a local area. Ultimate recovery from a dissolved-gas-drive field after pattern flood may range from 25 to 70 per cent. Typical recovery is about 42 per cent, twice that under primary.

●

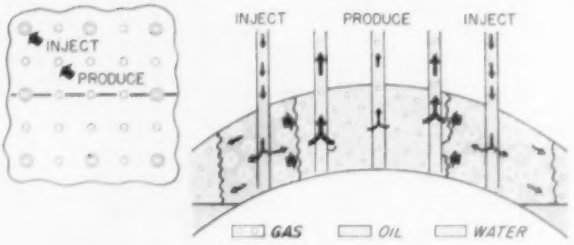
Line Water Flood

3. Injection of water in other than a uniform pattern is called line, edge, or peripheral flood. The object is to simulate a natural water drive. This type project may be started early to maintain pressure and producing rate. It is useful in deeper reservoirs since fewer wells are taken off production to be injection wells. Often it is possible to use gravity effects for better control of water production and more effective oil displacement.

Recovery efficiency of edge-water injection started reasonably early in the life of a field may range from

LINE (PERIPHERAL) WATER FLOOD

TYPICAL RECOVERY:
PRIMARY (DISSOLVED GAS DRIVE) 21%
SECONDARY (PERIPHERAL FLOOD) + 21% = 42% TOTAL
INCREASE OVER PRIMARY = 100%



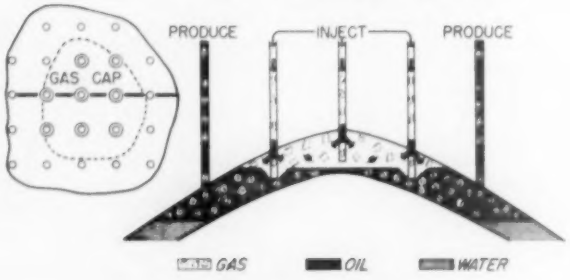
25 to 75 per cent. Typical recovery is 42 per cent, double that of primary. Gas may also be injected in a concentrated area or in the line in a dissolved gas reservoir. However, usually it is done so as to form or expand existing gas cap.

Recovery by primary water drive is normally efficient, so that secondary methods (in use today) are usually not needed or economic. However, if production exceeds the rate water invades a field, pressure decline occurs and part of the recovery is inefficiently supplied by dissolved gas drive.

●

GAS CAP INJECTION

TYPICAL RECOVERY:
PRIMARY (GAS CAP) 30%
SECONDARY + 10% = 40% TOTAL
INCREASE OVER PRIMARY = 33%



Gas-Cap Injection

4. Injection of gas into gas-cap-drive reservoirs is done to aid primary gas-cap drive. The more gravity effects can be used, the greater the recovery. Gas is injected in the higher areas. It may be injected to form a gas cap when none initially is present and thus aid gravity drainage, or it may be injected to maintain pressure and help expand a gas cap initially present.

The displacement of oil by gas-cap drive is the same by injected gas as under primary, and the same factors control recovery efficiency. Recovery depends largely on the effectiveness of the flushing of the pore spaces by gas as aided by gravity drainage, and the degree to which gas cap can be selectively produced or conserved. Gas cap injection not only improves recovery, but also maintains the oil producing rate. The produced gas may be processed in a plant and the gas cap cycled.

Recovery efficiency depends greatly on the gravity effects and the degree to which gas cap can be conserved. With appreciable gravity drainage, recovery of 40 to 80 per cent may be obtained, with 65 per cent fairly common. With only moderate gravity effects, lower recovery is expected, on the order of 20 to 60 per cent.

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Here's an analysis of Russian claims about

New Drilling Fluids in the Soviet Orbit

A realistic picture of the state of the Russian drilling industry is one of "lack" and "economy." "New and advanced techniques" about which there is great clamor in the Soviet press are largely stopgaps, inferior in many cases to western methods

Translated and assembled by George Rosu

THERE are few things that reveal the trouble spots of the Soviet orbit's economy better than some of the "advanced techniques" and "new methods" that appear in Soviet utterances in recent years. Doubt about their authenticity is often nurtured by the secretiveness in which they are shrouded. Soviet specialized publications seldom disclose the details or methods of a new technology; instead, they stress its exclusiveness. This is particularly true about the oil industry which, next to the nuclear program, is the least known sector of Soviet activity. And the "new drilling fluids" are typical examples.

Need produces short cuts . . . The claimed "new" techniques are: the rapid drilling method, the single-casing drilling technique, and the new drilling fluids. These methods work in a sort of compelling succession, and each one mirrors a specific deficiency or obstacle. The shortage of field outfits should be overcome by "rapid" drilling, e.g. by using more intensively the available drilling capacity through higher rotational speed, higher mud flow rate, and greater bit weight on the bottom.

Here the second method fits into the picture, e.g. the single casing should dispense with the costly intermediary casing. This short cut reveals the lack of steel pipe in the Soviet orbit, particularly that of the heavier type. Completing the picture of lack and economy, the Soviets now decree that costly chemically treated drilling muds used conventionally should be replaced by fresh water and by coal-base drilling fluids. With the exception of the coal-base muds there is, evidently, little in these "new" methods that is unknown to oil men outside the Soviet orbit.

Experiments in the U.S.S.R.

Drilling with water . . . In April 1953, Russia announced first success in drilling with water instead of conventional muds. One Socialist "hero," Richard Allayarov, claimed to have drilled 90 per cent of a 5,346-ft. well with water at Oktyabrsky (Bashkir A.S.S.R.). The drilling speed was 3,280 ft. per turbodrill-month and, thereby, surpassed the planned target of 2,296 ft. per month set for the same tool. This method has been spread since to other fields in Bashkiria, Tataria, and Kuibyshev as well as to a few Romanian fields. Subsequent trials claim better performances.

Despite the clamor of the Soviet press, drilling with water is not a Russian invention. For the last 10 years, this method has been successfully practiced in western Texas and other areas to drill through certain hard structures. The record shows that the penetration rate is higher when drilling through hard rocks with water than it is with mud. The progress is explained by better cleaning of pulverized rock from the hole bottom and by the cooling effect caused by the high circulation rates of the water. However, when the driller approaches salt or caving-shale formations, permeable formations that may bring about lost circulation, or high-pressure formations that may blow out, he must switch to an appropriate drilling-mud program.

The success achieved by the Stakhanovite brigade at Oktyabrsky may be explained through the local geological characteristics as well as those of the drilling tool used.

The Middle Volga basin—where the drilling was performed—is built on hard rocks. Under rather thin (60 to 130 ft.) surface sediments that are frequently crossed by foldings of pre-Cambrian rocks, lie Carboniferous limestones, and Middle Devonian sandstones. With the exception of the thin surface layer, the driller runs no danger of encountering fractured or highly permeable formations. Nor are formation pressures high. As long as high circulation rates are maintained to carry out cuttings, there is no need for a mud with specific properties of gel strength or cake-forming characteristics. The main problem in drilling the rock quickly is to keep the bit cool and to remove cuttings rapidly. At a premium here is a drilling fluid that can be pumped fast and has a high cooling effect. And this is fresh water.

The Middle Volga crude oil is heavy, and the oil-bearing formations have a low or no gas pressure at all. The danger of blowouts of gas or underground waters is practically nil. Consequently, there is no need of maintaining much hydrostatic mud pressure when drilling here. These facts explain Allayarov's performance. He used colloidal mud only for the surface layer and, again, while drilling through the semiconsolidated formations above the oil-bearing stratum.

Water-turbodrill combination . . . The second explanation of the rapid drilling is that the Soviet team drilled with a turbodrill. In this drilling system, the driving force has been moved from the surface to the bottom of the hole. The power is generated by a hydraulic turbine mounted at the lower end of the drill string. The circulating fluid fulfills here three roles, at the same time: it washes the hole bottom and lifts up the cuttings, as in rotary drilling; it passes through the vanes and turns the rotor of the turbine; it lubricates the rubber-lined bearings of the turbine.

Inasmuch as the pumps in turbine drilling double for rotary power equipment, they must be more powerful than those used with conventional rotary rigs. Water is ideal for getting good results from the equipment since it can be pumped at high velocity, and has low density and viscosity for minimizing pressure losses.

Ever since the practical application of turbine drilling on an industrial scale (about 1948-49), Soviet technicians have been searching for a more widely applicable drilling mud which should fulfill all these tasks and, in addition, be cheap. There is no sign so far that they have been successful in

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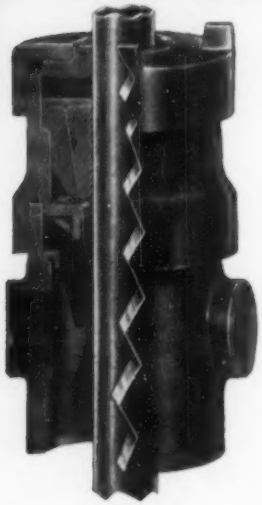

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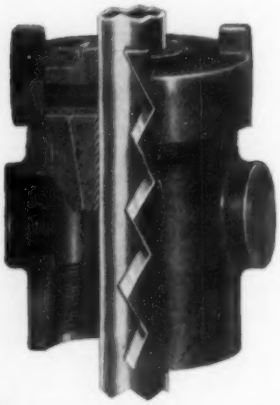

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finding ways to control the mud composition for turbodrills on a scientific basis.

Drilling with water performed in April 1953, and repeated afterwards has proved to be successful but is limited to regions where fluid loss and blowouts are no danger. For turbine drilling, muds of low solid content similar to water are desired. These will minimize fractional power losses in the turbine, in the well hole and, particularly, in the pumps. Their high circulation rates with low pressure losses allow high mechanical speed of the turbine and high pressure and energy at the turbine for development of rotary power.

Increased equipment life . . . As to the economic results, Allayarov's brigade claimed that use of water increased markedly the drilling speed, lengthened the period between repairs of the tool, and extended the life of the pump elements. This resulted in a saving of 11 rubles ($2.75 at the official exchange rate) per drilled foot as compared with rotary drilling and conventional muds. This means that the total saving on the hole amounted to 58,800 rubles or $14,700.

New mud additives . . . Almost a year ago, another experiment was completed, this time in the Saratov Province. By contrast to Bashkir, Saratov is Russia's richest natural-gas source. The local formations are carrying gas at high pressures. A first attempt to drill with water through the friable upper layers (clay and sand) apparently failed.

Inasmuch as neither fresh water alone nor water-clay muds proved satisfactory fluids in this area, Soviet technicians set out to mix a new drilling fluid in which should be combined the best properties of both.

The new fluid presently tried out in the Saratov fields is one of controlled properties, and may be described as a water-base mud with an original colloidal suspension. According to official disclosures, this is its recipe (in percentages of the drilling fluid weight):

	Per cent
Sodium silicates	10-20
Sodium salts of lignitic coal (UShChR)	5-25
As solvent—SSB	10-20

Although the SSB is not further defined in Russian texts, it should be explained that this is nothing other than a fluid product (active ingredient lignosulfonate) derived from the residues of the paper mills. Its specific weight is between 1.28 and 1.30. The active material contained in SSB has the property of lowering the filtration and viscosity of drilling muds. At present, the SSB is frequently used in the U.S.S.R. for conditioning drilling muds. It fulfills almost the same functions as UShChR

Coal-base mud . . . The sodium lignite (UShChR) is generally known as the coagulant of the coal components but otherwise it is still an unknown substance. It is found mostly in the lignitic coals, e.g. in those ranging from 50 to 81 per cent carbon, with a high hydrogen content and a low ignition point. As is well known, these coals are soft and elastic—qualities which render them suitable for briquetting. Their specific weight varies between 1.20 and 1.35.

The UShChR is far from being an elaborately prepared chemical substance. In practice, the mud formula is obtained simply by dumping powdered brown coal (or even refuse thereof) into the mud tank, and mixing it with sodium compounds. Little scientific control of the outcome can be had. In further experiments it is asserted that a mixture of coal powder and sodium hydroxide has a stabilizing effect on the mud.

Field tests . . . The coal-silicate-SSB mud formula has been tried in two wells drilled in Peshano-Umetsk field where water drilling caused cavings in a 670-ft.-thick friable Vereisk and upper Bashkir strata. As a further precautionary measure, the hole walls were protected by a special casing down to 1,230 ft. where the hard Podolsk-Kashirks calcareous beds were reached. Then these were drilled for another 950 ft. with water with little additives.

For the last leg of approximately 1,600 ft. (from 3,362 ft. to 5,084 ft. in Well No. 8—and from 3,214 to 4,838 ft. in Well No. 15), the admixture content of the mud used on the two wells was raised from 13.6 to 36 per cent, and from 1.5 to 34 per cent. The following quantitives of additives were used in each case:

Brown lignitic coal, lb.	35,000
Sodium hydroxide, lb.	5,300
Sodium silicate, lb.	16,100

On the last portion drilled, abnormal loss of circulation occurred which was, however, somewhat attenuated by adding more chemicals.

At the 3,200-ft. level a premixed slurry of the additives was admixed to the fluid. It consisted of (quantities per barrel of fluid):

Lignite powder, lb.	70
Sodium hydroxide solution, gal.	0.92
Sodium silicate, lb.	75

The drilling fluid changed in this way: specific gravity rose from 1.03 to 1.23; viscosity went up from 16 to 18 seconds (Russian viscometer SPV-5); water loss fell from 150 cc. to 10 cc.; and filter cake thickness dropped from 0.24 to 0.08 in.

Experiments in Romania

Drilling with water . . . The experiments were carried out in the Middle Moldavian region, namely at Moinesti (Bacau district). The geological structure has a certain similarity to that of Bashkir (Middle Volga basin where Allayarov drilled). Both are formed of hard rocks—the Middle Volga basin of Carboniferous, Permian, and Devonian; the Bacau of Crystalline-Mezozoic, Carpathian Flysch (with three subzones) and Neogen. In both regions, the oil-bearing formations have little or no gas pressure, the crude is heavy, and the danger of high water filtration minimal. The paying strata lie at depths of between 2,800 and 5,200 ft.

Water drilling in the Moldavian region makes up, at present, 3 to 4 per cent of the total footage, despite the fact that more than half of the cumulative drilling is claimed to be done with turbodrills. As officially admitted, the main obstacles that impeded the spreading of water-turbodrill drilling are: lack of tools, low mechanization level, scarcity of pipe and materials and, last but not least, the teams' insufficient technical training.

Soviet "targets" . . . The official source states briefly that water and light mud were used, and discloses only a few operating results. Two slush pumps were run in parallel, with a fluid volume of 666 to 713 g.p.m. and a flow pressure of 1,000 to 1,300 psi. Weight on the bit was about 40,000 lb. The average bit consumption is given as one per each 70 ft. drilled.

Of interest is the revelation of the Soviet planning yardstick as compared with the Stakhanovite (turbodrill) performance in this case. The following table has been computed from a few hints and percentages contained in the official account of the Moinesti performance:

	—Drilling time—	
Well No. 911, Moinesti—	Planned target	Stakhanovite performance
Depth, 3,575 ft.—Days	79	24
Total number of shifts (of minimum 7 men each)	237	72
Total shift-men required	1,659	504
Hole drilled per shift, ft.	15.2	49
Hole drilled per shift-man, ft.	2.1	7

The planned target mirrors the official pessimism as to the drilling capacity of the local drilling trusts. The claimed exceptional results attained in "Socialist competition" do not surpass any average performance in the free world. This "record," established 11 months ago,

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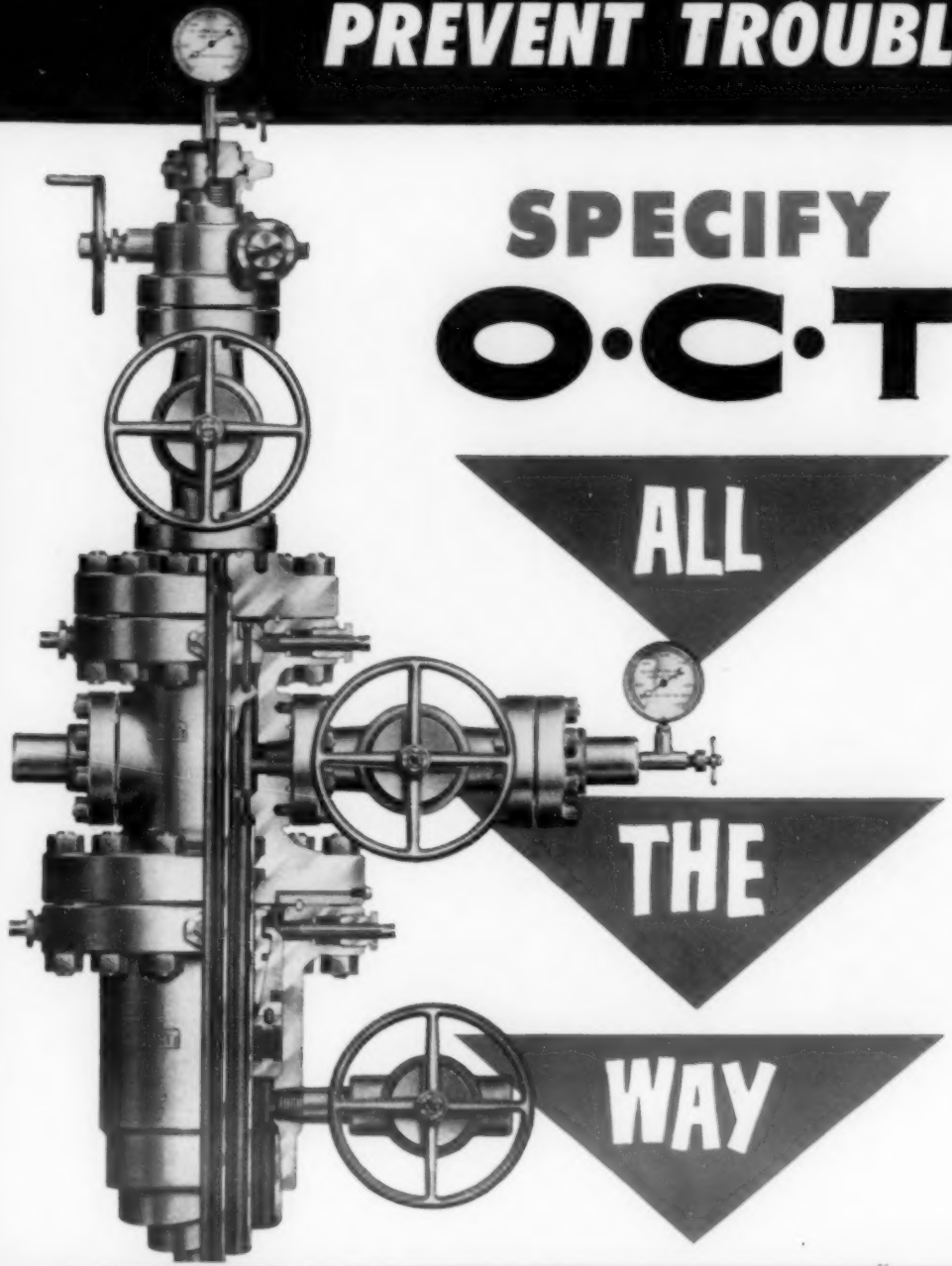

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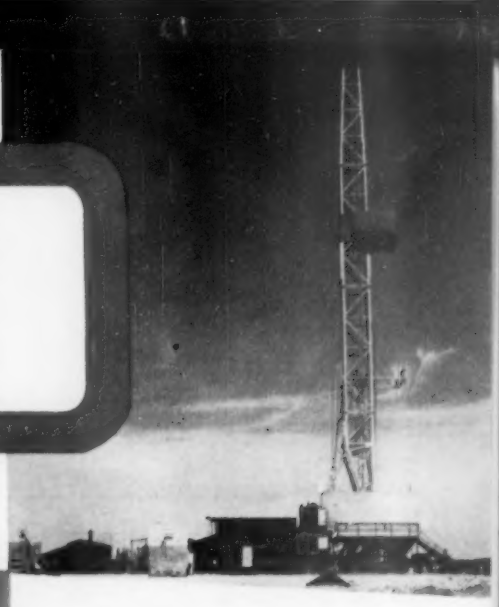

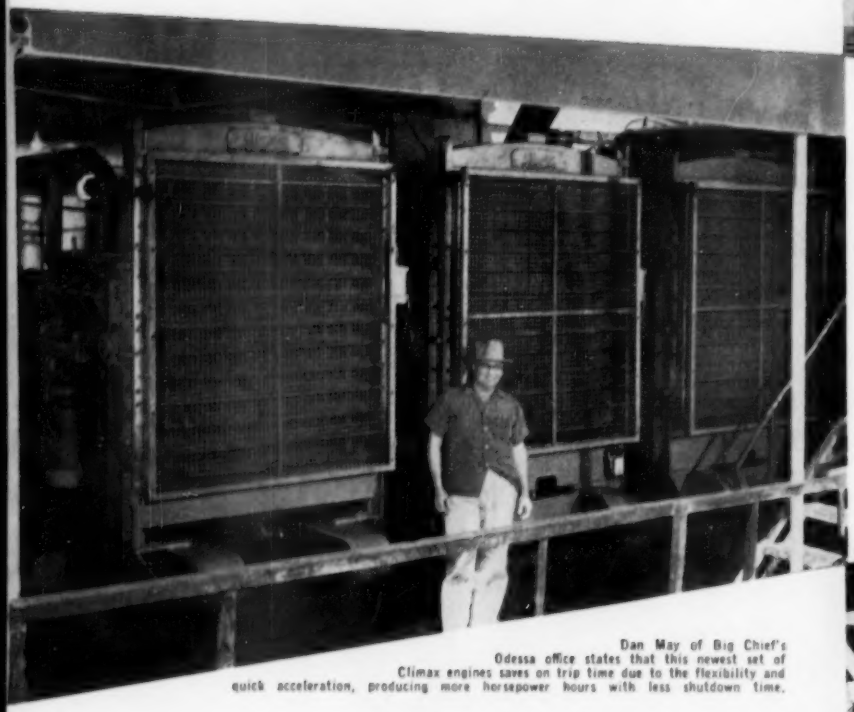

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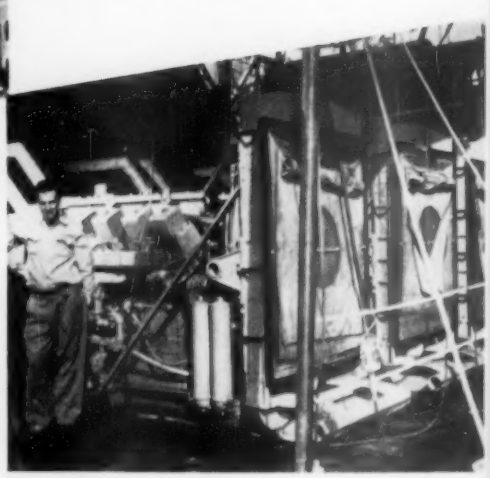

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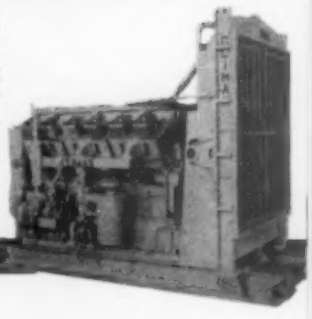
Arvin Traugott, tool pusher for Big Chief, is high in his praise of this first set of Climax engines put in service years ago by his company. These Climax engines are still operating efficiently and economically after a number of years service.



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is still an unsurpassed level for the Moldavian oil region for drilling with turbodrills and water.

Rotary drilling with water . . . Two other experiments were made in which water was used instead of the conventional mud but, this time, in rotary drilling. The first was performed toward the end of 1954 by a Stakhanovite brigade of the Drilling Trust No. 1 at Campina (Prahova Valley). The location was specially chosen so as to drill through a well-known structure of normal stratification. The geological log indicated conglomerates down to 2,000 ft., followed by sterile formations of loosely cemented sands and sandy marls, at the base of which were several coal packages. The experiment was done with the specific purpose of finding out the behavior of a coal stratum when drilled with water.

The equipment used was a heavy Soviet rotary table "Brackinets" with a usual washhead. The report stresses, however, that the washhead was operated at a speed in excess of that permitted by the factory specifications. The sizes of the two slush pumps used were 18 and 20 in. The official operating results are as follows:

Down to 426 ft.—Conventional mud.
From 427 to 1,374 ft.—Conglomerates.
  Drilling fluid—water.
  Drills used—3 roller bits.
  Average mechanical speed—46 ft. per hour.
From 1,375 to 5,205 ft.:
  Drilling fluid—water.
  Drills used—two fishtail bits.
  Average mechanical speed—27 ft. per hour.
Drilling regime applied:
  Pressure on the bit—22,000-26,000 lb. on roller bits, 18,000-22,000 lb. on fishtail bits.
  Table rotation—200-250 r.p.m. (limited by the washhead capacity).
  Pump flow—602 to 634 g.p.m.
  Flow pressure—600 to 650 psi.
  Specific gravity of hole-made mud—1.05 to 1.15.
Claimed speed—16,039 ft. per rig-month.

Drilling through the coal packages was, reportedly, performed without accidents and a month later no evil aftermath was noticed.

A second experiment was performed early this year at Boldesti (Prahova Valley). These are the official operating data:

Down to 492 ft.—Conglomerates.
  Conventional mud of 80-100 viscosity C.g.s.
From 493 to 3,936 ft.:
  Drilling fluid—water.
  Claimed mechanical speed—131 ft. per hour.
From 3,937 ft. to the pay sand (undisclosed depth):
  Conventional muds (to prevent a gas blowout).
Rotation speed—150 to 180 r.p.m. (as compared with a planned target of 80 to 120 r.p.m.).
Weight on bit—13,000-18,000 lb.

The claimed results should be considered as exceptional for conditions prevailing on Romanian fields, as they were reached by Stakhanovite teams supplied with the best equipment available at the Boldesti Drilling Trust. The **average** drilling brigade is equipped with tools that, on Western fields, would be regarded as bordering the castoff stage.

Romanian mud additives . . . The acute lack of mud chemicals caused Romanian petroleum chemists to start searching at the beginning of 1952 for the best domestic coal suited for use in drilling muds. Some 10 various kinds of coals (all of the lignitic group) were laboratory tested. Their viscosity performance was satisfactory but the mud filtration was bad. Finally, at the end of 1952, a trial of a mixture of Sarmasag coal, clay, and water showed good filtration values. The Sarmasag lignite is believed to contain the required quantity of humic acid. The reagent derived from it—called in vernacular "basic extract of coal"—consists of lignite mixed with sodium hydroxide, and is meant to become an appropriate substitute for sodium polyphosphate and quebracho extract. The mud thus prepared is claimed to be stable 3 to 4 weeks.

After 2 full years of experimentation, drilling with coal-base fluid was started on an industrial scale in January 1955 on a few selected Moldavian locations. The miraculous virtues of "black drilling" have been constantly hailed by the press ever since but no operating results are yet revealed. The inference drawn from an official source, however, is that only 30 to 40 teams are so far using this "advanced Soviet technique" in the whole of Romania. It is further claimed that the use of coal powder lowers the mud cost by 95 per cent and, consequently, cost per foot drilled drops to half of the current planned average.

What all this means . . . For half a century research to find better drilling fluids has never ceased. Many of the resultant fluids involve complicated mud formulas. Almost 100 different chemicals are used today for the preparation of suitable drilling muds. Newer drilling principles such as circulating air or gas are finding application in certain conditions. Their use may seem a reversal in the previous trend since they simplify the mud formula, but it is only through better understanding of drilling requirements that they have been successfully exploited. The potential of air and gas as drilling fluids is not yet fully explored.

As the preceding discussion points out, the search in this direction in the Soviet orbit is not at a standstill either. To say, however, that it is difficult to assess the success or failure of these activities is to repeat the obvious. The operating data and the tangible economic results are mostly withheld. The list of questions unanswered yet is quite impressive.

Nothing is known, for example, about the influence of the new fluids upon the productivity of oil wells drilled with this new method. Whatever information is available stems from experiments and selected operations, and from reports on Stakhanovite performances. The latter are being used mostly for exhibition purposes, for popularizing "new ways," for demonstrating that miracles are still possible. As their goal is to show success, the negative sides of such performances are, undoubtedly, passed over in silence. The documentary value of these data is, therefore, subject to serious questioning.

As to further prospects in the drilling fluids sector, this much can be said. The Russian or the Romanian oil technician has a wider range of problems to struggle with daily, as he operates in an economic system where bottlenecks are the rule. The pressure from above directs him to do it with whatever means are available, and to constantly cut down investments and costs. This pushes him to take even iconoclastic attitudes, such as challenging the principles of conventional drilling or dueling with thixotropic and rheologic fundamentals of drilling mud.

Whatever partial solutions are devised are immediately taken to the field for experimenting. This all taxes the man in the field far more heavily than in the free world. Whether the official drive and the challenge of obstacles alone (but with total absence of incentives and genuine emulation) are enough of a stimulus for human effort and ingenuity to cause real progress is, of course, a question open to discussion.

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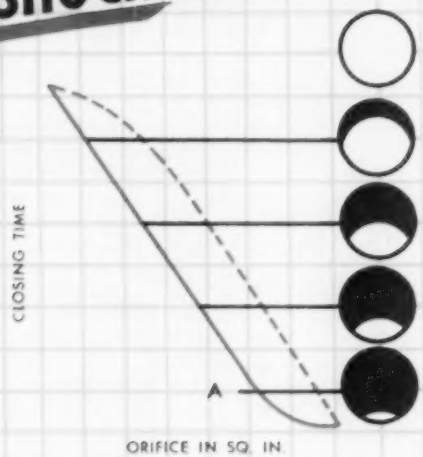

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HOW WELL DO YOU READ?

. . . and how you can improve your ability

by Dr. Nila Banton Smith

Part 1

DO you know how well you read? The first thing to do is to find out.

The average reader reads about 250 words per minute. A lesser number than this indicates a slow reader or a poor reader. Very good readers read 500 or 600 words per minute. A very superior reader reads 1,000 words a minute. And occasionally one finds an unusual person who reads 1,600 or 1,800 words per minute.

Speed, however, isn't the only consideration. Ability to c o v e r printed words rapidly is quite valueless unless one gathers meaning from reading as his eyes travel over the lines of print. Basically there are two major reading skills which lend themselves to development with guidance and practice. These two basic skills are **speed** and **comprehension.** The two must increase together. Comprehension must keep apace with speed or all is lost. If you should increase your speed to 600 words per minute and simultaneously drop your comprehension from 80 per cent to 40 per cent, your speed would do you more harm than good. So in these articles you will be asked to work on both speed and comprehension.

But before we do anything at all to improve your reading, let's find out what your normal rate is, and also get some idea of how well you are comprehending. You can then use these first scores as a basis for comparison in finding out how much you have improved later on.

Shortly, you will be asked to read the article on the next page. Read this selection just as you are accustomed to reading ordinarily. Don't hurry, and don't try especially hard to get the meaning. For test purposes just read in the usual comfortable way in which you would read a nontechnical article that you might pick up for a moment's diversion.

You'll have to time yourself in takink this test, so get out a watch with a second hand. At the moment that you are ready to start reading, note the time in minutes and seconds and jot it down on the margin of the page. Then read the article at your normal rate of speed and for the purpose of following the general trend of thought expressed. When you have finished, record in minutes and seconds the exact amount of time that it took you to read the article. You'll find other instructions at the end of the chapter.

Ready! Start!

Are you reading like you did in grade-school days?

IS your desk piled high with memos, reports, correspondence, bulletins, and other material which you don't have time to "wade through?" Do you tote a bulging briefcase home each night filled with leftovers that you aren't able to read during office hours? Would you like to know what a half-dozen leading minds are thinking about some current oil development which may affect your business decisions? Are you continuously lamenting, "I can't read all that I should. I just don't have the time?"

If you are like most businessmen of today, you probably answered all of the questions at once in the affirmative. It's a generally recognized fact that the modern businessman is enmeshed in a never-ending combat with printed words. There they lie before him in continuing accumulations, and it is imperative that he read these ever-mounting piles of print in order to dispatch his daily business activities efficiently.

Opinion of corporation presidents as expressed in a recent discussion held by American Management Association was that: **not less than 25 per cent** of an executive's time is spent in reading in connection with his business. At other levels, the consensus was that business employes spend at least 2 hours of each work day in some form of business reading.

It would appear then that reading is one of the most important tools which the businessman uses in his daily work. He goes to great lengths to install new machines, controls, and instruments in his establishment or plant to insure more speed, accuracy, and perfection. **Does he do anything about installing an improved tool in reading? He can and should.**

Fact . . . In the midst of the fast-moving current of American living, most businessmen are still using reading techniques they acquired in grade school many years ago. They creep along at 200 or 250 words per minute when they could easily escalade this rate to 500 or 600 words per minute. Why not install an improved tool in reading which will mesh in with the tempo of the other modern equipment in your office?

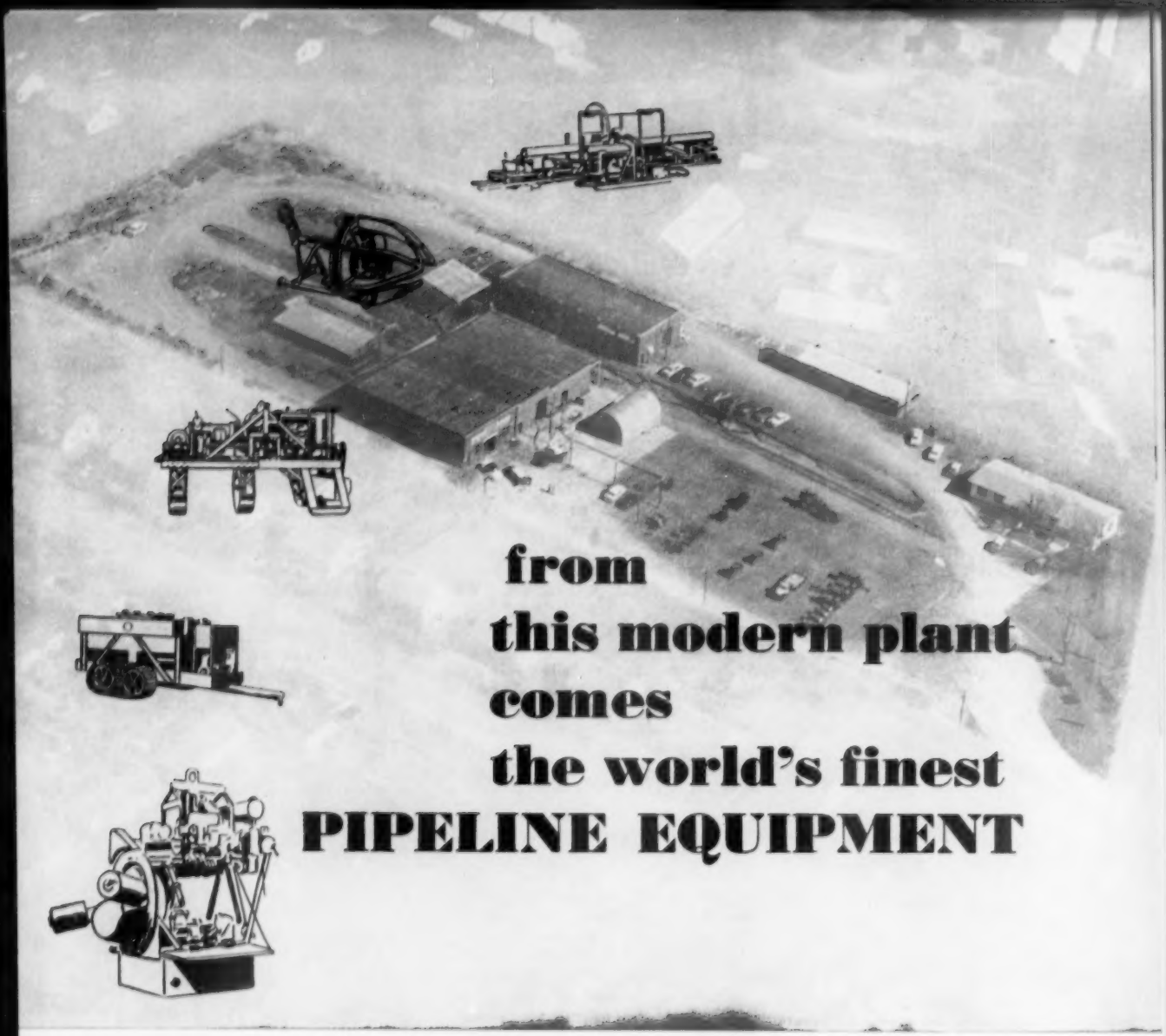
How can you do this? Helping you in the solution of this problem is the purpose to which these articles are dedicated. There is a new art of reading. This new art has arisen during the last few years in response to a deeply felt need by adults throughout America to read faster and better.

Why Do They Move?*

The Population Reference Bureau says that about 3 per cent of the nation's population move from one state to another each year. Many more persons undoubtedly move intrastate; the Institute of Life Insurance estimates that this year 31,000,000 people will pull up stakes and move to other homes. It is difficult to see why this is so. If moving one's household from one home to another in the same city, or from one city to another, were as simple as changing a pair of shoes, those figures pertaining to Americans on the move would not be surprising. But moving, and especially long-distance moving, is an incredibly complex, uncomfortable, unsettling, expensive, and distasteful operation.

Here in City A, for example, are old f r i e n d s and neighbors, old

*New York Times, March 15, 1954, p. 24.



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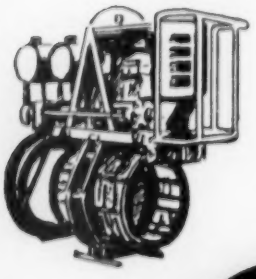

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haunts — familiar faces, familiar schools, familiar church, comfortable if not plush house—and firmly fixed habits. There, in City B, are neighbors of as yet undetermined humors, new surroundings and perhaps customs; strange schools and—at first glance—gimlet-eyed teachers, a church with perhaps different hymn books (very unsettling) to say nothing of a wholly strange order of worship. And high on the list of painful adjustments is the necessity of forming new habits, of finding new restaurants, perhaps changing one's mode of transportation. And then there is the little matter of the new house.

The matter of the new house appears on the agenda early in any moving operation. The lady of the (old) house says the new house must be larger, nearer to stores, nearer to schools, with a large yard, with fireplaces, a sunny kitchen, etc., etc. And the head of the (old) house finds himself saddled not only with the task of adjusting himself to new associates in what may be a totally strange place but also the responsibility of finding a new house answering the foregoing description. If he is wise, the head of the (old) house will somehow turn the important (and time-consuming) business of discovering a new house to the distaff side so that in the event matters turn out poorly he, and not she, can say, "Well, I didn't think much of the house in the first place, but I didn't like to say so."

But no matter what, the new house will be a problem. Even the most careful inspection of a house does not prepare one fully for living in it. Inspection before moving in does not prepare one for the discovery that the movers with their vanload of furniture—and what looks more worn and frazzled than the family heirlooms being carted across a pavement, from truck to house, in the cold light of day—and a small army of painters have arrived at the new house at the same time. Inspection before moving does not prepare one for the discovery that the previous occupants have decamped with all but three window shades, leaving the new residents and all their dusty furniture and their undisguised misery fully exposed to curious eyes.

Inspection does not disclose that, although one may come from a place where trash, ashes, and garbage were picked up twice a week, here at the new house trash is picked up once every 2 weeks on one day, ashes, if any, on another day, and garbage on still another. Or that the paper boy's aim at the new house is worse than a certain lad's aim at the old. Or that the new house's windows rattle alarmingly even in a light breeze. Or that there are fewer shelves in the kitchen than one had supposed. Or that one of the garage doors—a heavy, heavy door—is about to fall off.

But there is the new house—and its larger yard, just as the lady of the (old) house wanted it. With more grass to cut. A nice, big hedge to trim. Lots of trees to shed their leaves in season. And a lot of new neighbors who, as yet, do not appear to be the type eager to share any of their belongings with newcomers who have no shades on their windows and appear to be, for all the world, a bunch of gypsies with a heap of broken-down, or at least badly bent, furniture. The new house will be all right, some day, but when the movers have gone and the door is closed (stickily) the old house looks pretty good, wherever it was.

End—jot down your finishing time.

Checking Your Speed

Time Begun	:
Time Finished	:
Reading Time	:
Reading Rate	:
Comprehension Score	:

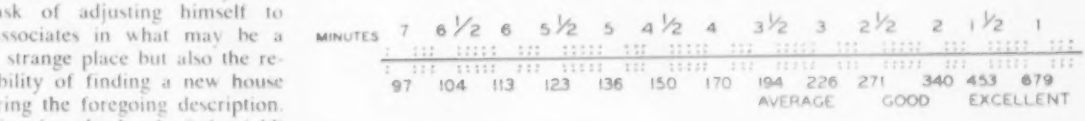
Refer back to where you jotted down the time that you began. Write it in the space above as: 9:22.

Next write your finishing time in the appropriate space above. For example, it might be 9:25 minutes, 30 seconds.

Subtract the time begun from the time finished as: 9:25 minutes, 30 seconds, minus 9:22 minutes = 3 minutes, 30 seconds, or 3½ minutes.

This answer will be your reading time.

Next locate the number of minutes which it took you to read the selection on the scale below. Under this figure, in the lower part of the scale, you will find a number which tells you how many words the article, you read at the rate of 194 words per minute. This is your "Reading Rate" and should be recorded as such in the appropriate space in the table.



Checking Comprehension . .

Without referring back to the article, read these statements and write "T" at the beginning of each one which you think is true, and "F" at the beginning of each one which you think is false.

- ☐ 1. The Population Reference Bureau says that about 5 per cent of the national population moves from one state to another each year.
- ☐ 2. The Institute of Life Insurance estimates that 31,000,000 people pull up stakes and move each year.
- ☐ 3. Among the new adjustments which must be made as enumerated by the article are: becoming acquainted with new neighbors, strange schools, a different church, and getting one's mail rerouted satisfactorily.
- ☐ 4. The article states that the lady of the old house wants the new house to be larger, nearer schools and stores, have a large yard, an outdoor fireplace, and a sunny kitchen.
- ☐ 5. According to the article, regardless of how careful an inspection of the new house has been made before moving in, difficulty cannot be fully eliminated.
- ☐ 6. When the article says that the wise head will turn the selection of the house to the distaff side, it means that he will turn it over to his wife.
- ☐ 7. In this article, the previous tenants were said to have departed with three of the window shades.
- ☐ 8. Other difficulties enumerated in the article are: garbage collection problem, the newsboy's aim, rattling windows, few shelves in the kitchen, a garage door about to become unhinged.
- ☐ 9. The new house which the lady wanted has these disadvantages to the man: more grass to cut, weeds in the lawn, a hedge to trim, lots of trees to shed leaves.
- ☐ 10. The article gives no reason as to why so many Americans undergo this trial of moving each year.

The correct answers are given below. Turn the page upside down, referring back to your answers and checking them.

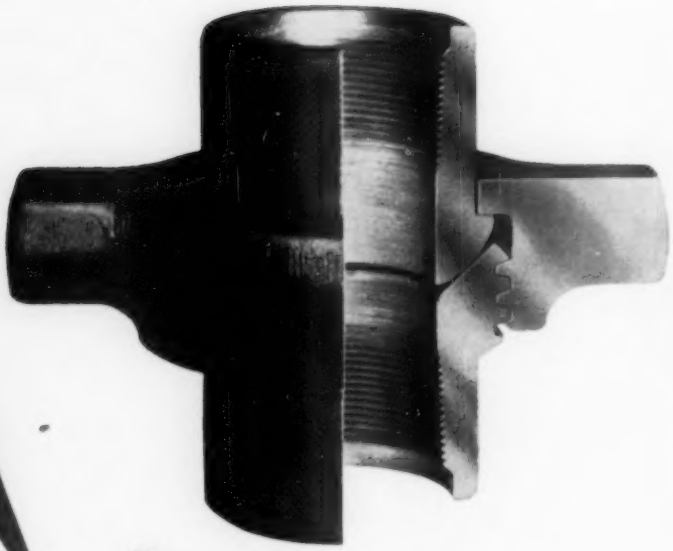
1. T		
2. F	5. T	9. T
3. T	6. F	10. F
4. T	7. F	
5. T	8. T	

Allow yourself a score of 10 for each correct answer. Multiply the total number you had right by 10. This will be your comprehension score. Write it in the table above.

The table now shows your present speed and comprehension scores in reading narrative material. You will wish to refer back to these scores as you progress. With the use of the new techniques described and the practice recommended, you should note improvement right along as you work your way through successive articles.

THE AUTHOR

Dr. Nila Banton Smith is an educator, lecturer, and an author with specialization in the field of reading instruction, and is a recognized authority on reading. She holds degrees from Chicago and Columbia universities. Currently she is director of the Reading Institute at New York University, and professor in charge of remedial reading programs and courses in the school of education at N.Y.U. This and two articles on the subject to follow in later issue are from Dr. Smith's forthcoming book, "Reading Improvement for Adults," which will be published by Prentice-Hall.



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PETROLIO E GAS NATURALE. By Dr. Mariano Amico. Published by Ulrico Hoepli, Milan, Italy. Two volumes, 1,544 pp.

Here's the first comprehensive description of modern drilling and production equipment and techniques ever published **in the Italian language.** A monumental piece of work, its 1,544 pages are illustrated with 1,174 drawings and photographs, and up-to-date technical data are presented in 94 tables.

The author has drawn upon drilling and producing from all areas of the world, and he has done an excellent job of compiling the newest and most significant of this information into the relatively small space of two volumes.

The opening chapters of the first volume present basic geological and geophysical technology on the location of world oil deposits, their origin and accumulation, and how geology and geophysics are used to locate potential pays. The rest of volume one deals with such drilling and production practices as well spacing, unitized field operations, rotary-drilling techniques and equipment, and so on.

The second volume opens with the newest methods of directional drilling and extensive data on drilling costs in various parts of the world. Then subsurface well equipment is discussed, casing and tubing qualities are analyzed, and casing programs and running-in practices are presented. The last five chapters cover formation testing, completion techniques, electrical and radioactive logging, and log interpretation.

Where both equipment and techniques are concerned, the author has chosen those that are generally accepted as the most effective and most modern now in use around the world. Many experimental methods and devices are also described, so that these volumes have every chance of remaining "current" for some time to come.

In all, these volumes are more than a credit to their author. They are also a tribute to the progressive bent of the new Italian oil industry.

THE OIL MAN WHO DIDN'T WANT TO BECOME A MILLIONAIRE. By Howard Brunson. Published by Exposition Press, 386 Fourth Avenue, New York 18. 84 pp., $3.

This autobiography is the story of a farm boy who worked his way up from roustabout to roughneck to driller to owner of his own drilling contracting firm, Brunson Drilling Co. of Wichita. Simply and sincerely told, it's an interesting account of one oil man's experiences in almost 50 years of work in the oil patch.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

Index (1946 = 100)

	1948	1950	1952	1953	1954	Sept. 1955
Pumps, compressors, etc.	127.0	138.2	155.6	162.5	166.5	173.8
Electrical machinery	127.6	134.9	152.4	156.4	160.0	165.5
Internal-combustion engines	116.9	126.0	146.5	148.1	150.5	156.1
Instruments	120.0	127.8	146.2	151.8	154.6	168.8
Heat exchangers	130.0	140.0	165.8	174.9	171.7	162.9
Miscellaneous equipment average	*122.1	*126.2	153.3	158.8	160.7	165.4
Materials component	139.3	149.5	164.3	172.4	174.6	180.7
Labor component	128.0	144.0	163.1	174.2	183.3	191.9
Nelson construction index	132.5	146.2	163.6	173.5	179.8	187.4

*Used in computing the Nelson Index until April 1952. These are slightly different than the average of the Miscellaneous Equipment Items shown above.

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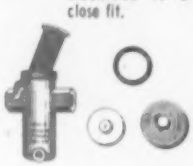
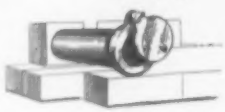
Air Control Door and Frame, top hinged, ratchet type, heavy duty, for manual control. Surfaces are machined to a close fit.

Fuel Oil Suction Strainer, single type. Large basket area insures low pressure drop; cover and basket easily removed for cleaning.



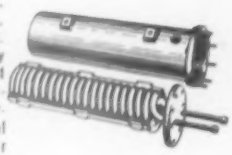
Wide-View Peephole, safety, curtain type. Cobalt glass removed to show bearing surface for curtain. Curtain halves are interlocked—open simultaneously.

Ignition Port with Refractory Tile No. M896 . . . for use with standard 3" pipe. Also serves as a peephole.



Furnace Relief and Access Door, heavy construction, practically air tight. Door casting correctly weighted, lined with plastic refractory retained by imbedded grill; with observation port and cover.

Fuel Oil Heater, Self-Cleaning, Spiral Coil Type. High oil velocity in coil, resultant turbulence prevents carbon formation. No internal connections or joints.



The "right combination" for you in achieving maximum combustion economy is: NATIONAL AIROIL Fuel Oil, Gas or Combination Oil & Gas Burning Equipment; NATIONAL AIROIL Combustion Accessories; and, NATIONAL AIROIL Engineering Consultation. May we be of help to you in accomplishing your particular installation or in solving that difficult problem?

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HOUSTON, TEXAS

PETROCHEMICAL REPORT

Steam Cracking Extended to Ethane, Propane Feed Stocks

ETHYLENE (aside from that amount recovered as byproduct from various petroleum processes) can be produced by the pyrolytic cracking of any hydrocarbon stock from ethane to reduced crude—although processes for all these feeds have not been proved commercially.

- In the United States, the principal accent to date has been on ethane and propane, since these gases are available in large volumes from refinery and natural gas.
- In Europe, on the other hand, raw gases in quantities large enough to supply ethane and propane feeds are lacking. There, manufacturers in the past several years have turned to pyrolysis of heavier oil fractions such as naphtha and gas oil.

Steam Pyrolysis

On a commercial scale the Kellogg steam-pyrolysis process was first adapted specifically to the cracking of heavy naphtha. Subsequent pilot-plant work led to process designs, embodying the steam-pyrolysis principle, for plants to produce ethylene from ethane and propane. At the same time, the naphtha pyrolysis design was extended to include gas-oil and residual-oil feeds.

Experience with these pyrolysis designs has brought out the following points, all of which bear directly on the domestic picture.

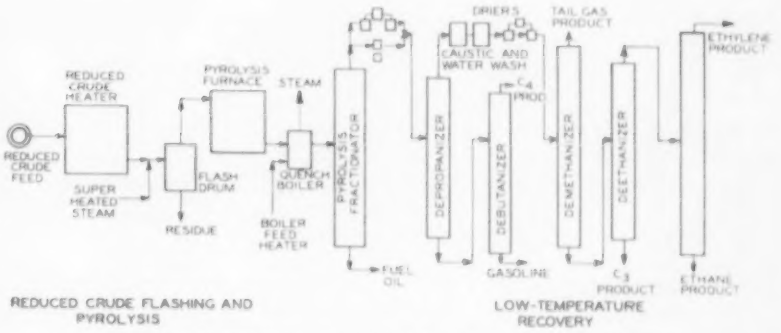
1. Ethane and propane plants with greatly improved operability can now be designed for high yields of ethylene.

2. It is possible to design plants for economic production of ethylene and other olefins from casing-head or natural gasoline, residuals, and other low-value products which tend to glut the market, thus allowing the refinery to dispose of marginal products at greater profits.

3. Studies based on Kellogg pilot-plant data indicate that these raw materials can be economically processed to olefins, giving the chemical manufacturer, also, an attractive proposition. (The table data show this would appear to be profitable today. In the expanded market foreseen for olefins, even more pronounced advantages could be expected).

Typical yields obtained from ethane and propane feeds are shown. (See table data). With heavy-naphtha and gas-oil feeds, ethylene yields as high as 32 and 26 weight per cent respectively have been obtained. With the latter feeds, the process also provides a high degree of flexibility in the production of other olefins and aromatics. By varying operating conditions, it would be possible for a manufacturer to alter proportions of particular olefins or aromatics in his output over a wide range, according to his most favorable market.

The formation of less-profitable sat-



STEAM PYROLYSIS of a residual feed stock to make ethylene.

BREAKDOWN OF DIRECT OPERATING COSTS, STEAM CRACKING

FEED STOCK—		Natural gasoline 26 R.v.p.		Refinery gas and propane mixture		East Texas heavy naphtha	
UTILITIES:	Unit cost	Quantity*	$/CD	Quantity*	$/CD	Quantity*	$/CD
Steam, lb./hour	70c/1,000 lb.	51,000	771	57,000	862	80,000	1,210
Electric, kw.	1.05c/kwh.	327	74	110	25	300	68
Cooling water, g.p.m.	1.4c/1,000 gal.	12,700	230	13,000	236	11,000	200
Fuel, MM B.t.u./hour	37.5c/MM B.t.u.	110	891	82	664	107	867
Total utilities			1,966		1,787		2,345
CATALYST AND CHEMICALS:							
Caustic, lb./SD	4c/lb.	400	14	3,500	126	1,300	47
Desiccant, lb./SD	14c/lb.	350	44	300	38	350	44
Diethanolamine, lb. SD	30c/lb.						
Total			58		164		91
Labor, men/shift	$55/man-day	7	385	7	385	8	440
Supervision at 10 per cent of labor			39		39		44
Maintenance at 4 per cent of process investment			658		475		586
Total direct operating cost			3,106		2,850		3,506

*Stream-day basis—90 per cent stream efficiency.

TYPICAL YIELDS FOR STEAM CRACKING OF ETHANE AND PROPANE

ETHANE PYROLYSIS (60 per cent conversion)		PROPANE PYROLYSIS (80 per cent conversion)	
Product—	Ultimate weight per cent	Product—	Ultimate weight per cent
Combined CO and CO_2	1.6	Combined CO and CO_2	0.8
Hydrogen	6.3	Hydrogen	2.1
Methane	7.2	Methane	21.7
Acetylene	0.6	Acetylene	0.3
Ethylene	75.7	Ethylene	36.1
Propylene and heavier	8.6	Ethane	7.8
		Propylene	19.7
		Butylene and heavier	11.5
Total	100.0	Total	100.0

Information from M. W. Kellogg Co., New York. Data on other feed stocks is available—for example, Kuwait vacuum residuum, in a combined Delayed Coking-Pyrolysis and Gas Recovery process scheme.

PETROCHEMICALS

OVER-ALL ECONOMIC SUMMARY† FOR STEAM CRACKING, DIFFERENT FEED STOCKS—(75,000,000 LB. ETHYLENE PER YEAR—90 PER CENT STREAM EFFICIENCY—EAST COAST LOCATION)

FEED STOCK—		Natural Gasoline (26 psi. R.v.p.) Pyrolysis and Gas Recovery					Refinery Gas and Propane Mixture Pyrolysis and Gas Recovery					East Texas Heavy Naphtha Pyrolysis and Gas Recovery				
PROCESSING SCHEME—				Per cent on feed					Per cent on feed					Per cent on feed		
Credits:	Unit price	B/SD	B/CD	Vol.	Wt.	$/CD	B/SD	B/CD	Vol.	Wt.	$/CD	B/SD	B/CD	Vol.	Wt.	$/CD
Ethylene	6.0c/lb.	114.1 (T/SD)	102.7 (T/CD)	55.0	34.0	12,324	114.1 (T/SD)	102.7 (T/CD)		28.1	12,324	114.1 (T/SD)	102.7 (T/CD)	52.0	26.3	12,324
Propylene	9.0c/gal.	815	733	27.0	22.8	2,771	757	681		17.0	2,574	628	565	19.5	13.2	2,136
C_3 LPG.	7.25c/gal.	31	28	1.0	0.8	85	610	549		13.4	1,672	23	21	0.7	0.5	64
Raw butadiene	5.0c/lb.	14.9 (T/SD)	13.4 (T/CD)	4.3	4.4	1,340						17.8 (T/SD)	16.0 (T/CD)	4.9	4.1	1,600
C_4 LPB	7.25c/gal.	309	278	10.2	9.6	847	104	93		2.6	283	73	66	2.3	1.8	201
Raw gasoline	12.0c/gal.	125	113	4.1	5.7	570	9	8		0.4	40	969	872	30.1	32.3	4,395
Fuel oil	$2.25/bbl.	3	3	0.1	0.2	7						153	138	4.8	6.6	310
Fuel gas	$2.25/bbl.	*611	*550	*20.2	22.5	1,238	*895	*805		38.5	1,811	*482	*434	*15.0	15.2	977
Coke	$5.00/ton															
Total credits					100.0	19,182				100.0	18,704				100.0	22,007
Debits:																
Feed stock—2,716 B/CD at 8.0c/gal.						9,126	1,314 B/CD (FOE) fuel gas at $2.25/bbl.				2,957	2,894 B/CD at 10.0c/gal.				12,155
							1,552 B/CD propane at 7.25c/gal.				4,726					
											7,683					
Direct operating cost						3,106					2,850					3,506
Taxes and insurance at 3 per cent of process investment						493					356					440
Interest at 4 per cent of process investment						658					475					586
Total debits						13,383					11,364					16,687
Net credits—$/CD						5,799					7,340					5,320
$/year						2,117,000					2,679,000					1,942,000
Approximate process investment‡						$6,000,000					$4,330,000					$5,350,000
Payout on process investment§—Years						2.83					1.62					2.75
Manufacturing cost of ethylene*—c/lb.:																
Feed-stock cost						4.44					3.74					5.92
Byproduct credits						—3.35					—3.11					—4.71
Direct operating costs						1.51					1.39					1.71
Depreciation						0.80					0.58					0.71
Taxes and insurance						0.24					0.17					0.21
Interest						0.32					0.23					0.28
Total manufacturing cost—c/lb.						3.96					3.00					4.12

*Fuel oil equivalent. †March 1955. ‡Excluding first cost of catalyst and chemicals. §Before depreciation, income taxes, royalties; and excluding offsite facilities. *Includes charges for depreciation at 10 per cent of process investment.

urated hydrocarbons can be reduced—a result of the low partial pressure at which cracking occurs. By producing high ratios of olefins to saturated hydrocarbons, steam pyrolysis provides for simplified separation of polyethylene-grade olefins as well as reduced feed stock costs charged against the desired olefinic products.

The Process

The steam-pyrolysis design for producing ethylene from a residual-oil charge is shown in the simplified flow diagram.

The charge is mixed with steam before going to a flash where any remaining liquid is removed. The steam reduces the partial pressure of the oil in the flash drum to a point where the feed can be substantially vaporized at a comparatively low temperature that will produce negligible cracking. It also reduces the partial pressure of the oil in the high-temperature pyrolysis step, thus insuring a higher percentage of cracking in the feed and increased yield of desirable product.

Cracking . . . Leaving the flash drum, the steam-hydrocarbon gas mixture flows through the pyrolysis furnace. After cracking, the hot gases flow through a quench boiler system which generates sufficient steam to meet all the requirements for cracking as well as some steam for compressor drives. Leaving the quench boiler the steam plus the products of pyrolysis flow to the fractionator tower where fuel oil is removed as a bottoms product and gasoline and lighter components are charged to the recovery section.

Recovery . . . In the recovery section, the steam is first fractionated in a depropanizer and debutanizer into three cuts—propane plus lighter, butane-butadiene, and debutanized gasoline products. The propane plus lighter stream is treated for the removal of H_2S, and then dried. At this point acetylene can be removed by hydrogenating it to additional ethylene if the final ethylene product requirements are such as to demand it. Leaving the driers the process gas stream is chilled and partially condensed in a series of propylene and ethylene-cooled exchangers. After chilling, the process stream is fractionated into tail gas, ethylene, ethane, and propylene-propane products in a three-tower system.

The purity of ethylene from this system can be 90.98 per cent, depending upon the requirements involved. If higher-purity ethylene is required, it can be obtained in purities as high as 99.9 per cent by the addition of topping and tailing stills as a final step.

Reference

1. King, C. C., and Warburton, J., "Ethylene From Naphtha or Gas-Oil Cracking," The Oil and Gas Journal, December 8, 1952, page 92.

Arabian wildcat thrives on

"ONE-SOURCE" SERVICE

Wildcatting in distant places is always rugged work, but for one of National's customers operating in Dhofar, Arabia, the problems were unusually big. LST's and rafts had to beach thousands of tons of drilling equipment and other supplies from a freighter anchored off shore. A road had to be blasted over a 3,500-foot mountain range—monsoon-drenched and impassable all summer. Then sixty miles of desert to the drilling site, where it's 135 degrees in the afternoon. Yet the rig is up and drilling.

National Supply had the single responsibility of providing drilling equipment and all other supplies for this Arabian wildcat. We shipped one of our Type 80-B consolidated rigs and tons of drill pipe from Houston, along with trucks, jeeps, air-conditioned trailers, camp supplies, medicines, fuels—everything needed by crews located in the middle of a desert. To help insure efficiency in rigging-up, a National engineer traveled to and spent several days at the rig site.

Usually oil men have one of our 124 stores nearby where they can get everything from a can of paint to major equipment. Other times, as in Dhofar, we provide for their needs over long supply lines. In either case, operators know they can rely on the dependability of our one-source service, and the quality of our equipment.

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You move mud at low cost

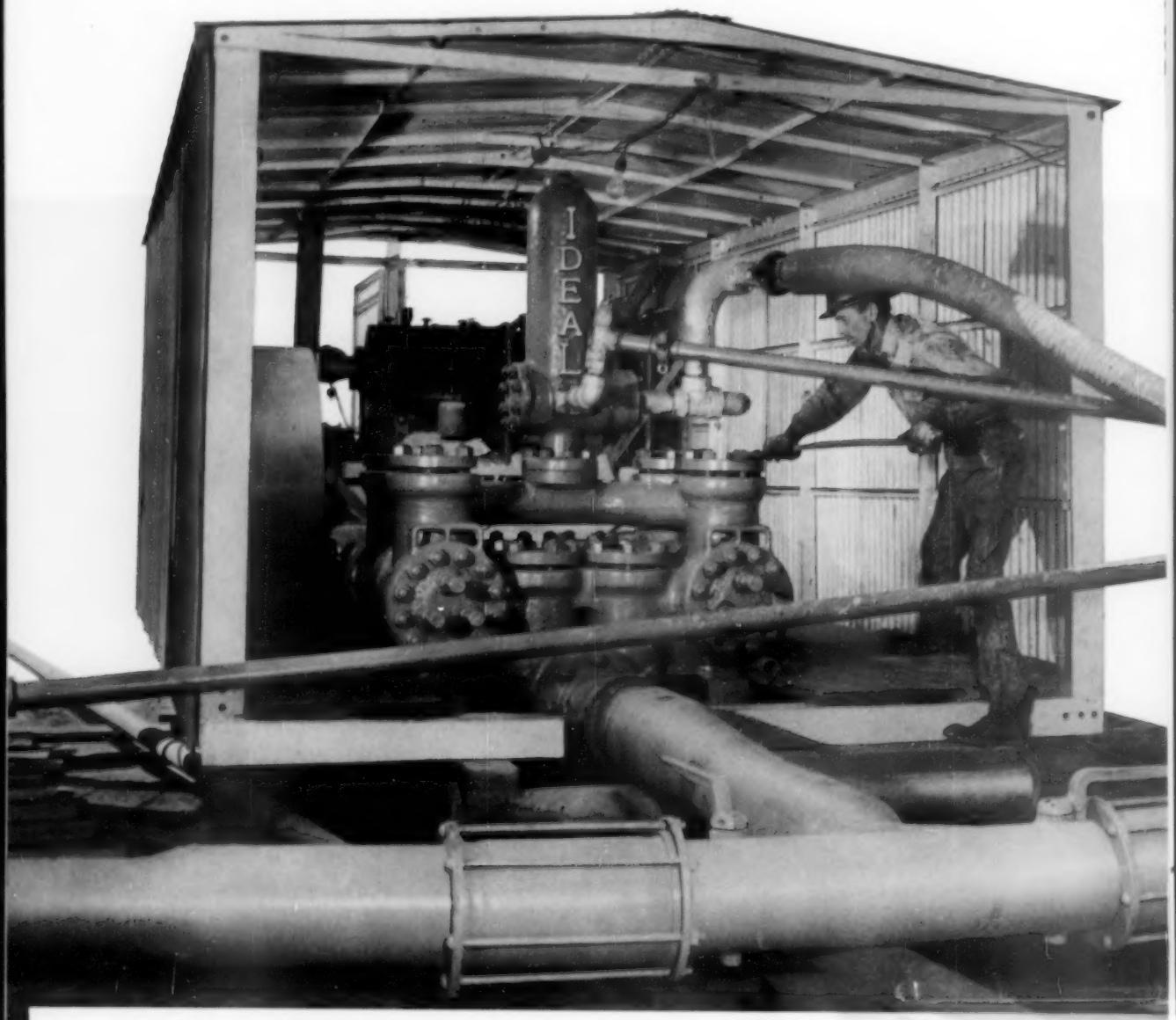
with IDEAL® Slush Pumps!

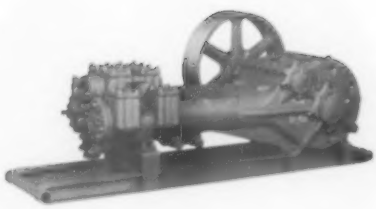
When you install the Ideal Slush Pumps that are right for your volume and pressure needs, you're well on the way to a low cost mud system. All Ideal pumps, ruggedly built for dependable service under a great variety of drilling conditions, have the mechanical and hydraulic features that insure sound action, easy maintenance and long life.

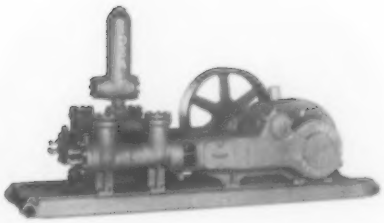
Their sturdy power ends include such features as pre-loaded main bearings,* mounted independent of the frame to reduce impact loading, hardened gears and completely enclosed, self-actuating lubrication systems. Their fluid ends—one-piece castings with no internal baffles—feature large, direct suction passages, smoothly curved for minimum resistance to fluid flow. Ideal Slush Pump frames are designed and built to insure a minimum amount of deflection, and all working parts are easily accessible.

All of these features, backed by National's 40 years of experience in mud pump design and construction, add up to top performance at minimum cost—wherever you put them to work. Check the chart on the next page, and ask the National representative in your area for more details on the Ideal Pumps that meet your needs best.

*Patented







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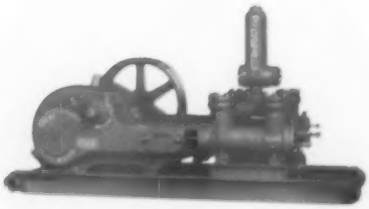
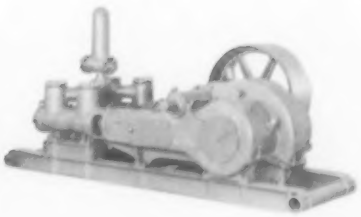
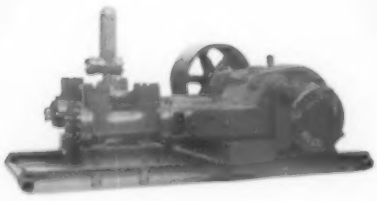
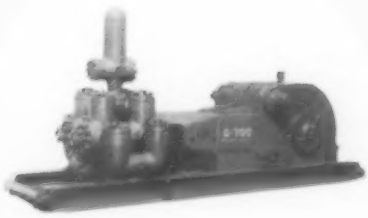
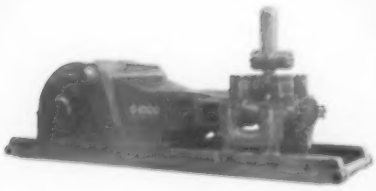




Type	Rated Max. Input H.P.	Rated Output H.P.	Rated Speed R.P.M.
D-50	80	68	75
C-100	150	128	75
C-150-B	220	187	70
C-250	370	315	65
C-350	600	510	60
G-700	700	595	70
G-1000	1000	850	65







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Whether you use them in Ideal Slush Pumps or pumps of other makes, you can count on Ideal Fluid End Parts to give long service life, reduce replacement costs and keep pumping efficiency high. For these reasons, precision-made Ideal Fluid End Parts have been important factors for many years in slush pump preventive maintenance programs throughout the world's oil fields.

You'll find these field-proven parts specially-packaged to insure factory-checked quality when you install them —look for their bright blue and yellow label next time you're in one of National's 124 stores . . . or ask the National representative in your area for the parts you need. Ideal Fluid End Parts are obtainable abroad through the Export Division of National Supply.

Gaskets and Packing—Selected for resiliency and resistance to the effects of chemicals or temperatures.

Liners—Hard, precision-finished working surface for long life, plus carefully-controlled outer dimensions insuring proper fit in pump cylinders.

Rods—Metallurgical control insures maximum resistance to abrasion, corrosion and wear.

Pistons—The type "GT" piston is made of a tough, resilient rubber, molded on a solid metal core to create a positive seal. The replaceable cup-type "Dual Seal" piston with API tapers is the latest addition to this Ideal family. Two cups at each end of the "Dual Seal" insure a positive, trouble-free seal.

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See the next page for more information on lower pump costs ···➤

by W. L. Nelson
Technical Editor

COST-imating

Nearly All Cost Indexes Have Increased

NOT since the summer of 1950 just after the Korean war developed, have prices so consistently increased. All of the itemized cost indexes tabulated herein have increased since May 1955 except seven which have remained the same. The increase in wages to steel workers and the increase in steel prices during July appear to have been a signal for a general rise. Iron and steel items rose 6.2 to 8.2 per cent and the Nelson Index rose more sharply than during any 3-month period. The end is not in sight.

The Cost Indexes may be used to convert prices known at any date to prices at other dates or the present, by ratios of the cost indexes of the same dates. Similar itemized cost indexes are published quarterly in the first weekly issues of January, April, July, and October. In addition, the Nelson Refinery Construction Cost Index is published in the first issue each month of The Oil and Gas Journal in the Engineering and Operating Section. (In this issue the Index will be found on page 111.)

Itemized Cost Indexes

(Multiply the 1946 prices of the Cost-imating Series by these Index Numbers divided by 100.)

	1948	1950	1952	1953	1954	Aug. 1955	References*	Index for earlier years (The Oil and Gas Journal) in Cost-imating issues
Labor:								
Skilled construction	125.0	140.0	157.9	167.3	174.6	181.3	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	131.0	148.1	168.2	181.2	192.1	202.0	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	128.0	144.0	163.1	174.2	183.3	191.6		No. 61—Dec. 15, 1949
Refinery operation	126.0	137.6	155.1	165.2	169.5	175.4	Sur. of Current Business	No. 55—Nov. 3, 1949
Equipment or materials:*								
Arc-welding machinery			151.3	154.7	158.4	163.7	Code ‡11-76	May 2, 1955§
Boilers, tanks, and sheet metal	†140.0	†136.0	†153.4	†150.3	147.3	153.0	Code 10-72	April 21, 1952§
Boiler tubes, 2-2¼ in.	131.3	149.5	168.8	188.3	199.4	219.7	Code 10-14-61	Sept. 5, 1955§
Building materials (nonmetallic)	120.6	127.0	134.8	140.7	143.6	149.8	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	122.8	132.5	140.6	142.8	144.7	151.2	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	133.3	153.4	167.1	181.8	193.1	213.1	Code 13-42	May 30, 1955§
Castings (foundry products)	144.6	152.9	168.0	176.8	181.1	184.5	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	121.3	134.6	145.8	153.1	159.1	170.8	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	119.4	125.3	132.7	137.8	142.1	147.1	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	118.9	124.4	132.6	135.9	138.5	139.8	Code 13-3	
Electrical machinery	127.6	134.9	152.4	156.4	159.9	161.7	Code ‡11-7	May 2, 1955§
Electrical motors and generators	128.6	135.0	154.6	157.1	157.7	155.4	Code ‡11-73	No. 31—May 19, 1949
Electrical switchgear			161.4	165.0	171.2	176.4	Code ‡11-75	May 2, 1955§
Electrical transformers, etc.	127.0	131.6	148.0	156.9	161.9	161.0	Code ‡11-74	No. 31—May 19, 1949
Engines (composite)	116.9	126.0	146.5	148.1	150.5	153.2	Code ‡11-54	No. 36—June 23, 1949
Exchangers	130.0	140.0	165.8	174.9	174.5	156.2	Manufacturer	No. 2—Oct. 28, 1948
Fans and blowers	131.3	162.9	183.7	185.5	192.6	206.9	Code 11-47	Feb. 17, 1949§
Hand tools	125.2	143.2	155.1	165.4	173.8	185.8	Code 10-42	June 27, 1955§
Instruments (composite)	120.0	127.8	146.2	151.9	154.6	162.9	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)		114.0	132.3	147.8	161.6	182.7	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)		138.5	160.5	170.4	179.6	192.2	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)		135.5	155.2	151.5	146.5	157.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point		134.0	151.5	157.8	167.2	173.3	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control		134.1	144.9	152.6	150.5	160.0	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder		135.6	158.4	163.7	166.3	171.1	Manufacturer	No. 34—June 9, 1949
Pressure gage		101.2	108.6	108.6	108.6	108.6	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)		124.0	149.4	152.6	152.8	158.9	Manufacturer	No. 34—June 9, 1949
Control valve		133.3	155.5	162.5	162.0	162.0	Manufacturer	No. 34—June 9, 1949
Insulation materials	126.8	125.0	130.4	133.5	135.5	131.9	Code 13-72	
Lumber (composite)	181.0	193.0	203.2	201.1	197.8	213.1	Code 8-1	No. 7—Dec. 2, 1949
Lumber (Southern Pine)	174.3	176.9	191.2	189.6	181.2	188.4	Code 8-12	No. 7—Dec. 2, 1949
Lumber (other soft woods)	206.5	230.2	248.5	256.8	252.7	268.2	Code 8-13	
Machinery—general purposes	124.9	136.7	151.8	155.1	159.9	167.2	Code 11-4	Feb. 17, 1949§
Machinery—construction	127.8	140.1	157.5	162.3	165.9	171.5	Code 11-2	
Machinery—oil field	†125.9	†135.8	†149.9	†156.3	†161.9	†171.4	Code 11-51	Oct. 10, 1955§
Paints—prepared	141.4	140.9	155.7	156.7	159.0	161.9	Code 6-21	May 16, 1955§
Pipe, sewer	110.9	120.7	136.9	136.1	140.1	150.5	Code 13-45	No. 22—Mar. 17, 1949
Pumps, air compressors, etc.	127.0	138.2	155.6	162.5	166.5	170.9	Code ‡11-41	No. 29—May 5, 1949
Steel (iron and steel)	141.1	152.9	168.5	177.4	179.6	195.1	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	135.7	153.7	170.0	182.7	187.1	201.6	Code 10-14	
Steel—plate and sheet		(See boilers, tanks, etc., above)						
Steel—structural shapes	145.0	162.7	176.2	185.7	193.4	211.8	Code ‡10-14-31	No. 18—Feb. 17, 1949
Valves and fittings	†125.9	†135.8	†190.8	193.1	197.1	209.0	Code ‡11-49 (1-6 & 11-14)	No. 46—Sept. 1, 1949
Nelson Refinery Construction	132.5	146.2	163.6	173.5	179.8	186.6		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology, The Oil and Gas Journal. *Revised. ‖Preliminary.

by W. L. Nelson
Technical Editor

COST-imating

Summary for Quick Cost Estimates

Item—	Material and labor,*** per cent: Average	Range Compute	Labor as per cent of material***	Notes (*)
1-9 Various types of process equipment*				
10. BASIC PROCESS EQUIPMENT (subtotal)	32.0	10-40[1]	20-40[1]	(†)
11. Piping (process)	15.3	8-33[1 8 9]	70-100[1]	(‡)
12. Insulation, fireproofing and paint	3.3	0.7-10[1 5]	200-600[1]	(§)
13. Instruments and controls, boards, etc.	3.7	1.4-8[1 5 6 7]	23-36[1]	(¶)
14. Foundations, except on process buildings, stills, etc.	1.7	0.4-4.1[1 5]	75-150[1]	(‖)
15. Structural frames, walkways, platforms, etc.	1.5	0.3-4.5[1 5]	30-50[1]	(**)
16. Buildings (process), pump houses, control rooms, etc.	2.7	0.2-8.1[1 5 9]	100-250[1]	(††)
17. Electrical wiring (service and light)	1.5	0.3-5[1 5]	150-200[1]	
18. Sewers and drains for process units	Low	2.5[6]		
19. Miscellaneous	1.3	0.3-1.9[1 5]		
20. AUXILIARY PROCESS EQUIPMENT (subtotal	31.0	20-50		
21. Temporary office, tool house, roads, etc.	Low			
22. Tools and rental of rigging gear	1.8	0.2-6.5[1]		
23. Superintendent, timekeeper, accounting, etc.	2.6	0.7-4.4[1]		
24. Equipment testing and acceptance runs	3.4	1.4-6[1]		
25. FIELD EXPENSES (subtotal)	8.0	2.7-17[1 3]		
26. Preliminary designs and cost estimates	3.4	0.7-8[1 4]		
27. Engineering, drafting, supplies, etc.	4.8	1.4-12.3[1 3 4]		
28. Purchasing, accounting, etc.	0.5			
29. Overhead, travel, finance, etc.	2.4	0.4-6.7[1 3]		
30. HOME OFFICE EXPENSE (subtotal)	11.0	3.7-20[2]		
31. (PROCESS) PLANT COST—DIRECT	**82**	**78-89**	***43 (24-61)[1]	(‡‡)
32. Overtime on labor, bonuses, etc.	0.5	0-7.5[1]		(§§)
33. Insurance, taxes, liabilities, etc.	2.5	2.1-2.9[1]		(‡‡)
34. Contingencies	7.5	1.3-16.5[1]		
35. Contractor's profit	7.5	1.7-10[1 3 4]		(¶¶)
36. (PROCESS) PLANT COST—TOTAL	**100**			
POSSIBLE AUXILIARY SERVICES OR COSTS				
37. Storage tanks	12	3-29.5[1 2]	20-45[1]	
38. Loading racks, railroad, docks, etc.	4.7	3.4-12[1 2]		
39. Buildings (office, labs, warehouses, etc.)	10.5	2-36[1 2 9]	82-190[1]	(‡‡)
40. Shops (mechanical, carpentry, welding, instrument, etc.)	8.5	6.5-12[1 2]		
41. Land (cost, title, surveys, drains, fence, lights, etc.)		0.1-62[1 3]		
42. Fire-fighting equipment	3.6	0.2-9[1 3]		
43. Utilities (steam, refrigeration, gas, water, etc.)	21.5	9.9-35[2 3]		
44. Piping (transfer, utilities, sewers, etc.)	13.4	10.4-46[1 2 3]		
45. Inventories (lab., warehouses, etc.)				
46. Royalties, paid-up				
47. Operating capital	18	8-31.5[1]		

How to Use Summary In Arriving at Estimate

MANY items of the total cost of a plant cannot be easily estimated and these may be obtained by ratio to the cost of the major or Basic Process Equipment. Somewhat the same is true of many labor costs. Approximations of these ratios or proportions are indicated in the tabulation shown here.

It is especially necessary to estimate contingencies, profits, etc., and these as percentages of the (Direct) Plant Cost (which is 82 per cent of the Total Plant Cost) are about:

	M. & L., % Average	Range
31. PLANT COST—DIRECT	**100**	
32. Overtime, etc.	**0.6**	**0-9.6**
33. Insurance, etc.	**2.8**	**2.4-3.1**
34. Contingencies	**9.3**	**1.5-21.0**
35. Profit	**9.3**	**1.9-12.8**
36. PLANT COST TOTAL	**122**	**112-128**

The costs of auxiliary equipments, services or costs shown at the end of the tabulations apply primarily to the cost of complete refineries. These auxiliaries such as storage tanks, utilities, loading racks, buildings, roads, etc., for a complete refinery, seldom constitute less than 100 per cent of the Total Costs of the (Process) Plants.

One foreign refinery[7] complete with camp, housing, sanitary water, dry docks, container manufacture, ice plant, etc., involved auxiliary service costs of 425 per cent of the Total (Process) Plant Cost (and with power generation even 445 per cent). However, for (expensive) chemical plants Bauman[5] suggests auxiliary costs of only 42 per cent.

The apparently wide ranges of percentage in the tabulation arise by natural differences. Thus, a process which involves many compressors will show a large cost for Basic Process Equipment, and a large foundation cost. In some processes insulation assumes a significant percentage of the total cost whereas in other processes instruments may become significant. Some construction jobs are routine and require no contingency factor whereas some others must be worked out on the job at great expense. Finally, profits range from as low as 3 per cent on large routine jobs to as much as 15 per cent on the smallest jobs or when existing equipment must be utilized.

Footnotes

*These items are computed in detail from various issues of Cost-imating. Included are such types of equipment as (1) direct fired heaters (pipestills), stacks and foundations, (2) vessels, towers, separators, absorbers, strippers, etc., (3) exchangers, heaters, coolers, etc., (4) pumps, compressors, motors, driers, jets, etc., (5) run-down storage, and (6-9) miscellaneous processing equipments.

†Happel[1] suggests M. & L. is only 15-30 per cent.

‡M. & L. is 30-62 per cent of Item 10.[1] Author finds labor sometimes is 156 per cent of material.

§M. & L. is 5-15 per cent of Item 10.[1] Labor is only 120-150 per cent of material.[2]

¶M. & L. is 10-25 per cent of Item 10.[1]

‖M. & L. is 4-8 per cent of Item 10.[1]

**M. & L. is 2-10 per cent of Item 10.[1]

††M. & L. is 10-25 per cent of Item 10.[1]

‡‡Compensation, old age, etc., constitutes 6-12.7 per cent[1] of the labor cost.

§§Up to 16 per cent of labor.

¶¶Expected profits range from 5 per cent for largest jobs to 10 per cent on the smallest.

‖‖Labor is only 32-42 per cent of material, for galvanized iron construction.

***Labor includes compensation, old age, etc.

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JOB IMPROVEMENT FOR THE PROCESS FOREMAN—36

Do You Know Enough About Mechanical Seals?

Q. What is a stuffing-box seal?

A. A stuffing-box seal is a mechanical device that performs the same function as stuffing-box packing but is much more efficient and dependable.

Q. How does a stuffing-box seal work?

A. A nonrotating ring is mounted in the gland plate, leaktight. A rotating ring is mounted on the shaft, leaktight. Each ring has a flat-lapped face. A spring holds these faces together by sliding one ring toward the other. And the flat faces match so well that fluid does not pass between them.

Q. How can one of the rings slide toward the other and still be leaktight where it slides?

A. A properly designed packing arrangement makes this possible.

Q. Why doesn't this packing wear out?

A. There is no rotary rubbing action on this packing, only a small amount of axial movement.

Q. Why don't the flat faces rubbing together wear each other out quickly?

A. Materials used in the faces of these rings are selected for their ability to run together with very little friction.

Q. Does a mechanical seal need any adjustment after it has started to work?

A. No. When the seal is properly applied to the pump it requires no further attention throughout its life.

Q. What is the life of a mechanical seal?

A. A well-engineered seal will operate for thousands of hours.

Q. Don't mechanical seals leak at all?

A. A properly engineered and applied mechanical seal does not leak.

Q. Do mechanical seals cost more than shaft packing?

A. Yes, but you get the added cost back.

Q. How do you get your money back?

A. You don't lose products at so much per gallon or pound. You don't spend time adjusting packing fit. You don't have to buy and install new packing. You don't have to shut down your pump when you need it. All these things that you don't have to do would cost you money if you had to do them.

Q. What about safety? Will the mechanical seal overheat?

A. A mechanical seal will not overheat unless it is asked to do a lot more than it was designed to do. A mechanical seal will "run dry" much longer than a pump packing without overheating.

Q. What can be done to insure that the seal will not run dry?

A. Tapped connections can be provided in the gland so that product from the discharge side of the pump can be directed to the vicinity of the seal faces.

Q. Does this lower the efficiency of the pump?

A. Only very slightly. The fluid from the discharge side is returned through the throat bushing of the pump or through another line to the suction side of the pump. In either case the flow is controlled to the minimum amount required by a flow-control valve.

Q. How can "flashing" be prevented between the seal faces when handling volatile materials?

A. By the flooding technique described above. In other words, by insuring the presence of fluid product to the vicinity of the rubbing faces, thereby keeping the faces cool and lubricated.

Q. Are volatile fluids adequate for seal-face lubrication?

A. Yes, if flashing is prevented.

Q. What can be done to cool the seal area when the product is at high temperature?

A. The discharge line providing product flow to the seal faces can be run through a cooler.

Q. What can be done in cases where the fluid handled contains abrasives?

A. The product can be directed through a filter before reaching the seal-face area. This filter would be in the discharge line between the discharge tap and the connection at the gland. In cases where the abrasive matter is in too great a volume to filter, a double seal is provided and filtered product is maintained between the seals at discharge pressure.

Q. What protection is provided in the event of seal leakage or failure?

A. Vent or drain connections are provided so that product leakage is directed away from the point of operation. In those cases where failure would constitute a hazard, either an auxiliary stuffing box or a close-fitting throttle is provided at the outboard end of the seal.

Q. When a mechanical seal finally fails, is it necessary to replace it with a complete seal?

A. No. Only the wearing parts need to be replaced. The rest of the seal should last as long as the pump.

Q. Are replacement parts standardized?

A. In a well-designed seal the parts requiring eventual replacement are standardized to shaft size. They are interchangeable on all seals of that size except on very difficult sealing applications requiring special materials.

Q. Are mechanical seals difficult to apply?

A. Mechanical seals should be designed to fit the pump or equipment on which they are to be used. Good machine-shop practice is all that is required to apply the seal. A good mechanical-seal design will be self positioning at assembly and will not require any measurements or "setting."

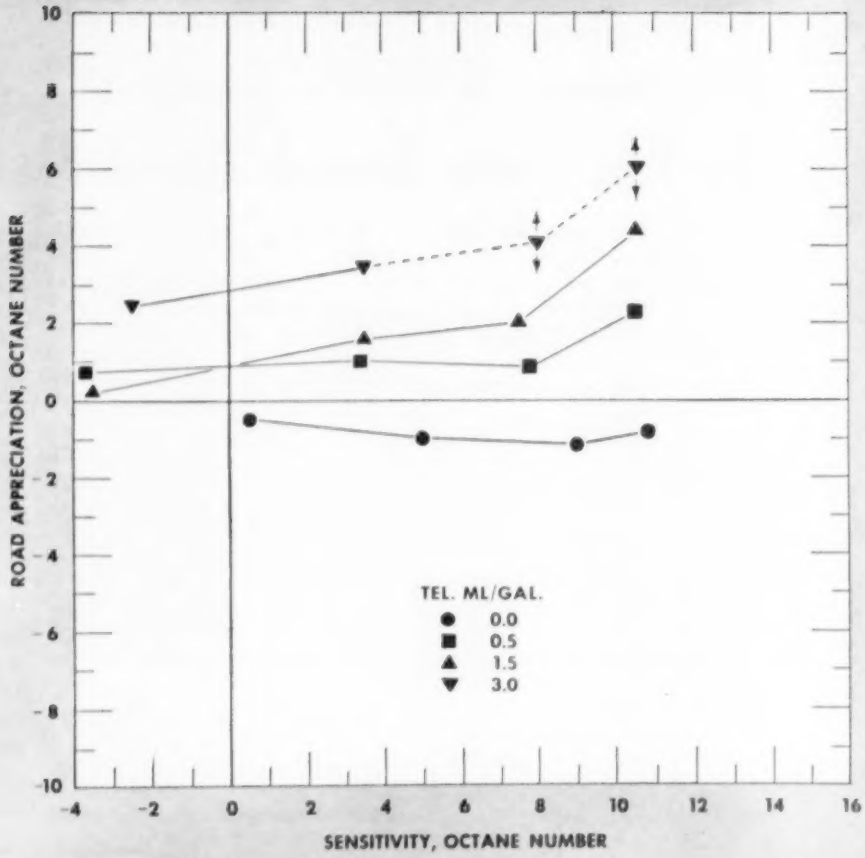

Fig. 1. Sensitivity versus appreciation. Note that the appreciation at any given sensitivity level increases with lead concentration.

Blending Hydrocarbons for Maximum Octane Potentials

By F. D. BUERSTETTA
Ethyl Corporation, Detroit, Mich.

The manufacture of high-octane gasolines to meet today's and tomorrow's automotive demands is putting increasing pressure on the refiner. To meet these requirements, the available hydrocarbon components in the refinery must be blended to best advantage to give maximum performance on the road.

Each octane number at the 100-octane level may cost as much as 15 to 20 cents per barrel. Thus there is a marked incentive for insuring that every laboratory octane number, obtained at this great expense, provides corresponding antiknock performance in cars on the road.

Hydrocarbon blends studied

As part of a continuing Ethyl Research program to establish the fundamentals of laboratory versus road antiknock quality, a study was recently conducted in which the behavior of blends of pure C_7 and C_8 hydrocarbons was examined.

Within this C_7-C_8 range, the four basic hydrocarbon types — olefins, paraffins, naphthenes and aromatics — were blended in varying proportions. Actually, a mixture of isooctane and *n*-heptane was used as the paraffin constituent to permit maintenance of a constant Research octane number while investigating the effects of tetraethyllead concentration and variations in hydrocarbon-type composition. Toluene, diisobutylene and methylcyclohexane were selected to represent the aromatics, olefins and naphthenes, respectively. Each of these hydrocar-

Send for your free copy of a technical paper entitled "Octane Possibilities with C_7-C_8 Hydrocarbons" by F. D. Buerstetta and T. W. Warren. Address your request to Box 11, Ethyl Corporation, 100 Park Avenue, New York, N.Y.

bons was blended in concentrations of 20, 40 and 60 per cent by volume with the proper paraffin mixture, giving nominal Research octane levels of 92, 96 and 100 at each of four tetraethyllead concentrations—0.0, 0.5, 1.5 and 3.0 ml. per gallon.

Each blend was evaluated in single-cylinder laboratory test engines and was then rated in the 9 to 1 compression-ratio engine of a 1955 passenger car equipped with an automatic transmission. Road ratings were made by both the Modified Uniontown and Modified Borderline techniques.

Road appreciation defined

Some of the test results are summarized in Table 1 in terms of road appreciation, which is the road antiknock rating of a fuel minus its Research octane number—or the bonus obtained in actual engine performance over the indicated laboratory knock rating.

The general analysis of data shown in Table 1 may permit a refiner to achieve better road performance than could be secured by using only Research octane number as a guide. It will be seen that aromatics should be maximized and olefins minimized as much as possible when making top-octane fuels. Since most of today's catalytic reforming processes eliminate naphthenes through dehydrogenation to aromatics, consideration of them is somewhat academic, but nonetheless interesting.

Further evaluation of the large quantity of test data obtained from this project indicates a most interesting correlation between appreciation and the concentration of tetraethyllead. Figure 1 shows a plot of sensitivity versus appreciation with points representing the same tetraethyllead concentrations connected. It can be seen from Figure 1 that the appreciation at any given sensitivity level increases with lead concentration.

Conclusions

The general conclusions which can be obtained from the study are as follows:

1. Best over-all antiknock performance can be obtained by blending a high proportion of aromatics with paraffins and adding the maximum amount of tetraethyllead.

2. Where low-speed knock resistance is critical, high aromatic content is necessary.

3. Where high-speed antiknock performance is critical, high aromatic content is less important, but maximum tetraethyllead concentration is still essential.

Table 1. Average change in road antiknock appreciation with addition of aromatics, olefins or naphthenes to paraffins in the C_7-C_8 range.

Research Octane No.	Added Component	Modified Uniontown	Modified Borderline	
			Low Speed	High Speed
92	Aromatics	+0.6	+1.1	+0.6
	Olefins	+0.3	+1.1	−2.0
	Naphthenes	+0.6	+2.0	+3.8
96	Aromatics	+0.9	+1.7	+0.6
	Olefins	+1.6	+1.1	−3.3
	Naphthenes	+2.4	+4.2	+2.7
100	Aromatics	+0.8	+1.5	−0.7
	Olefins	+0.5	+0.0	−5.7
	Naphthenes	+3.4	+3.7	+1.7

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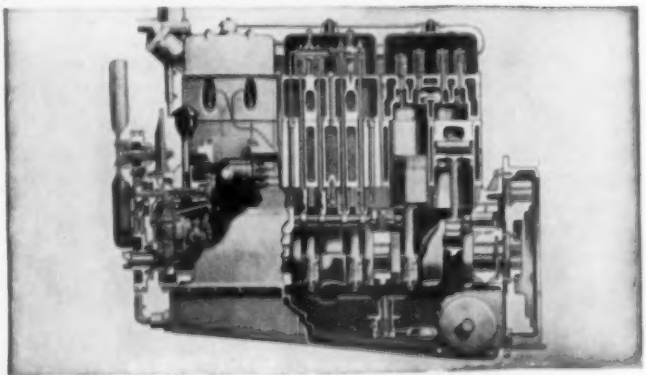


Engine cross-section shows how MM cooling maintains the entire engine at a constant temperature. Variation maximum is 4° to 5°. Automatic thermostatic control and by-pass system act as heater or cooler—engine runs at constant temperature under all operating conditions.

CALCULATION OF SURFACE TENSION—6

Finding Surface Tension of Hydrocarbon Liquids

by Ovid Baker

and

Will Swerdloff

FOR hydrocarbon liquids, four methods of calculating surface tension are available. They are given in increasing order of accuracy.

Method 1 . . . This method is for preliminary estimates only and is limited to crude oil containing natural gas in solution — for example, the liquid phase in a two-phase pipeline.

1. Obtain the A.P.I. at 60° F. and atmospheric pressure for the stock-tank oil.

2. Estimate the surface tension of the stock-tank oil from Fig. 8.

3. From Fig. 9 estimate the decreased surface tension of the oil containing dissolved gas at the pressure of the system. The surface tension of the oil at high pressure is expressed as a percentage of the surface tensions at atmospheric pressure. The range of values shown indicates the effect of different gravity oils and gas compositions on surface tension.

Authors are with natural gas department, Magnolia Petroleum Co., Dallas.

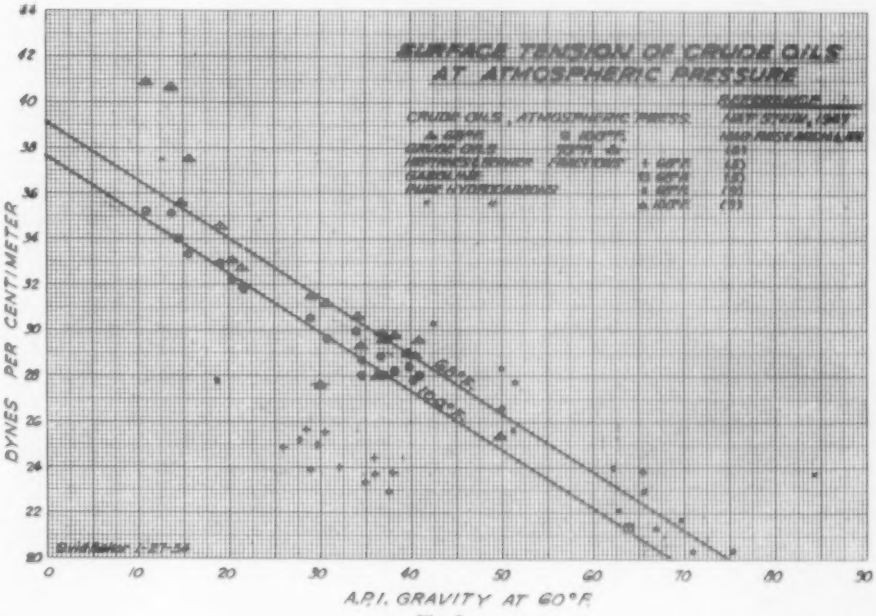


Fig. 8

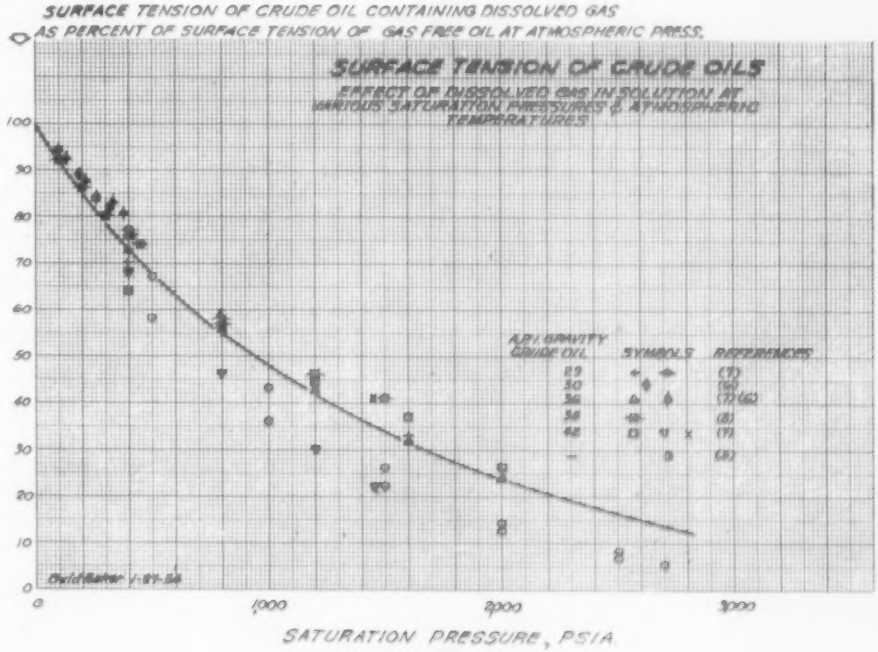
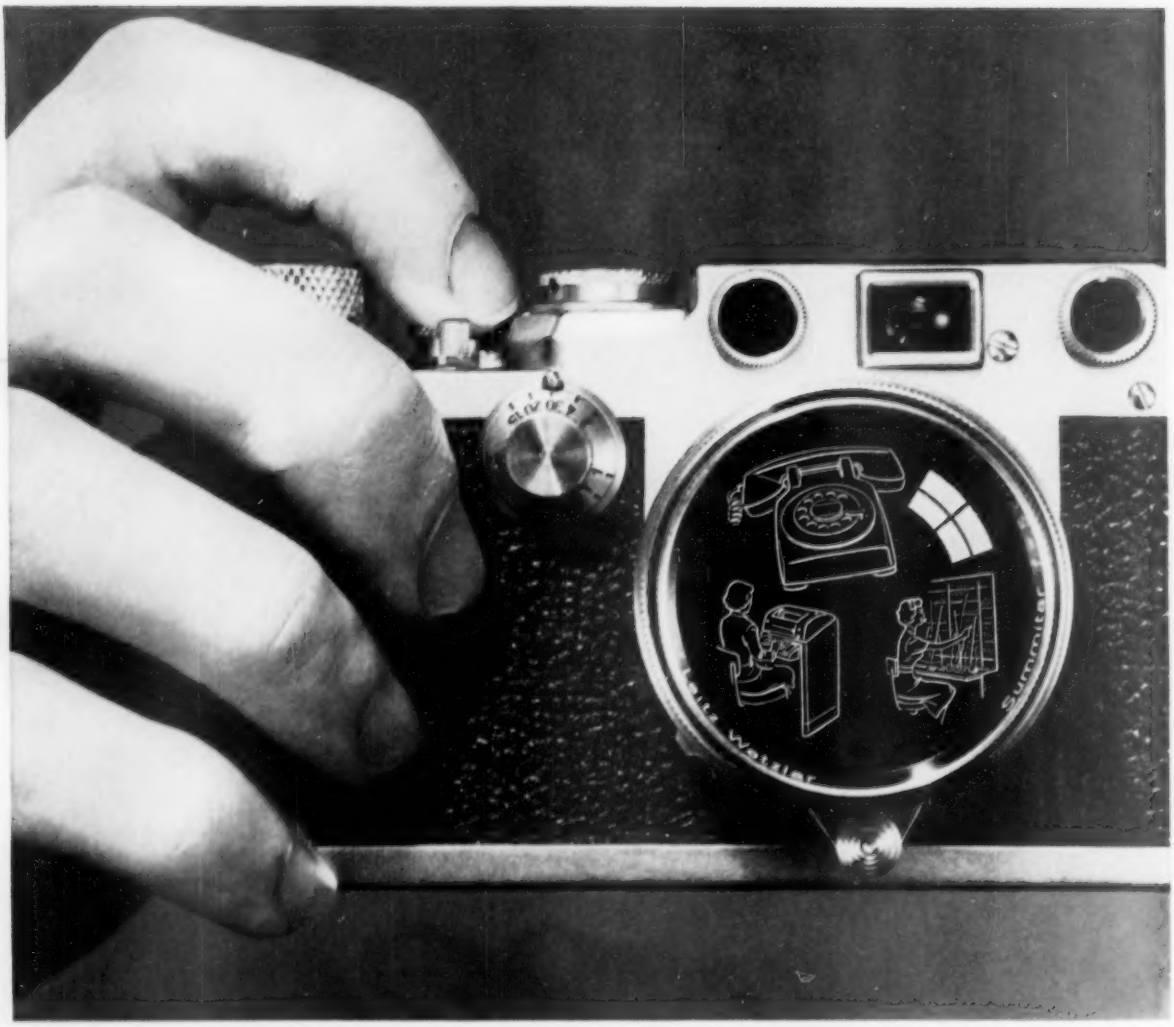


Fig. 9



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1 New section is lowered in as a buffer is used to clean pipe.

2 Cut is made with standard roller cutters. Burrs left by cutter will be filed off.

3 Coupling is in place on new section. Note bonding cable behind coupling.

4 Sections are lined up; some oil drains into ditch, emphasizing value of coupling.

5 Coupling is in place and set screws are tightened to give seal.

6 Pumping resumes as welder begins work to finish sealing coupling.

This technique for products pipelines provides . . .

A Safer Way to Cut and Weld Main Line

by Hobart A. Payne

WHEN replacing a section of main line, it is necessary to remove products from the line, cut out the old section, and then tie in the new section by welding. This report shows how the section can be replaced and the line returned to service without using a cutting torch or welding equipment. Doing this requires a special coupling for the final tiein—a coupling that effectively reduces hazards involved in the job.

Author is with Valley Pipe Line Co., Morro Bay, Calif. Paper presented at regional safety conference of Western Oil and Gas Association, Bakersfield, Calif.

The work to be described required replacing a 600-ft. section in our 10-in. line. The line is in a narrow valley and has block valves located 1 mile either way beyond the hills. With many hills and sags between block gates, we could only hope to drain out about 50 per cent of oil in the line. Working room was limited since one tiein was in a city street and the other was alongside a main highway.

The coupling which made the job safer consists of a steel sleeve 10 in. long with a 1-in. wall thickness. Its inside diameter is ⅛ in. larger than the pipeline. Both ends have an internal neoprene packing ring backed up by a movable steel thrust ring.

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PIPELINE PATROL

Twelve set screws at either end, working parallel to the pipe, force the steel ring against the neoprene packing to form a seal between sleeve and pipe.

In addition, the coupling has 12 set screws at either end working perpendicular to the pipe to control lateral movement. The coupling fits loosely when placed over the pipe, but is quite rigid when it is made up. It will withstand working pressures up to 2,000 psi.

How the Job Is Done

Photographs with this article give the high points in making this safe tiein. But some extra explanation may clarify the steps.

1. The first step is hot-tapping a 3-in. connection near the point of cutting. This is made into the section to be removed. Next the line is shut down, the main line block gates closed, and all possible oil pumped out of the dead section. This oil is pumped out through the 3-in. connection and into trucks. Then a 4/0 bonding cable is attached to both the old and new lines on both sides of the point of cut. This protects against cathodic protection currents arcing across the cut. The cable will be left in place until the old section of pipe is replaced and the new one tied in.

2. Now the new section is lowered into place and the exact line to cut is marked on the old section. A buffer then cleans scale and rust where the coupling will fit. This provides the best possible surface for the coupling sealing ring.

3. Standard roller cutters are then used to make the cut. Just before the cut is completed, all burrs should be filed from the outside surface of the line so the coupling will slide onto the pipe easily. The time to do this is before any spark hazard exists.

4. With the old section removed, burrs are then filed from the inside of the line at the cut point. A rubber plug inserted in the line seals off the vapors. After filing, the rubber plug is removed.

5. The coupling is placed on one section, the new section is lowered into its final position, and the two ends are aligned, and shows the line-up procedure and also that some oil was seeping out at this time. Under these conditions the couplings valve becomes apparent.

6. With the pipe sections lined up, the coupling is centered over the cut. The end thrust screws are adjusted and made up tight to affect a seal. Here again the coupling has an advantage because it will accommodate considerable misalignment. In this particular job, we might have taken hours if we had been lining up for a butt weld where close spacing is necessary.

7. With the thrust screws made up for sealing and the vertical screws made up to prevent lateral motion, the line is ready to go back into service.

8. With oil flowing through the line again, it is safe to go on with welding operations. In this case, welding was started immediately, but it could have been delayed for days if necessary since the coupling will withstand high pressure.

9. In welding the coupling to the pipe, tack welds are first made around the pipe, then the clamping screws burned off and seal welded. The thrust screws are left until last so they may be tightened against the seal in case a leak develops. Welding time for the job was about 3 hours and 15 minutes. Seven passes were required to weld the coupling to the pipe.

With the welding completed the tie-in is ready for cleaning, priming, and coating. The job has been done under the safest possible conditions as laid down by the A.P.I.—welding while the line is full and the stream moving through it.

The old method . . . How would this job have done in the past? The line would have been tied in while empty. And, to reduce hazards of welding on an empty line, the following procedure would have been followed:

1. After the line had been drained and cut, open ends of the section left in place would have been plugged with suitable material to isolate the welding area.

2. Then safety vents would be installed so that any oil or gas seeping by the plugs would be detected and could be drained off.

3. To reduce the amount of oil handled, air vents would be put on high points of the line. This would insure a good drain down while emptying and also vent any expanding gases that might cause slop over from sags not completely drained.

But in a tiein operation, the sections have to be lifted, jacked, and moved about to obtain good alignment. Any mishandling may loosen the plug. So success of this type of operation, with the old method, depend on diligence and good judgment of those in charge.

Summary

In comparing the two methods, it is easy to see advantages of the later. With it, we removed a 600-ft. section of old line, installed a new section, and put the line back in service without welding equipment or cutting torch.

PIPELINE PATROL

The final welding was done after the line was back in service, thus greatly reducing the welding hazard. Had the area around the tiein been dangerous, welding could have been postponed for days until the area was cleaned up and made safe.

Portable, adjustable racks make pipe handling easier

FOR easy handling of pipe during reconditioning work, here are two ideas used by Posey Tool Co., of Casper, Wyo. Fig. 1 shows a pipe-support-

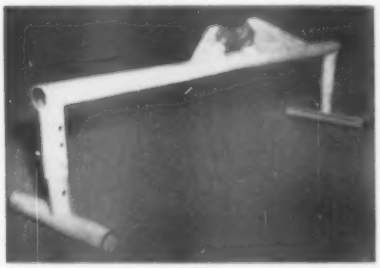


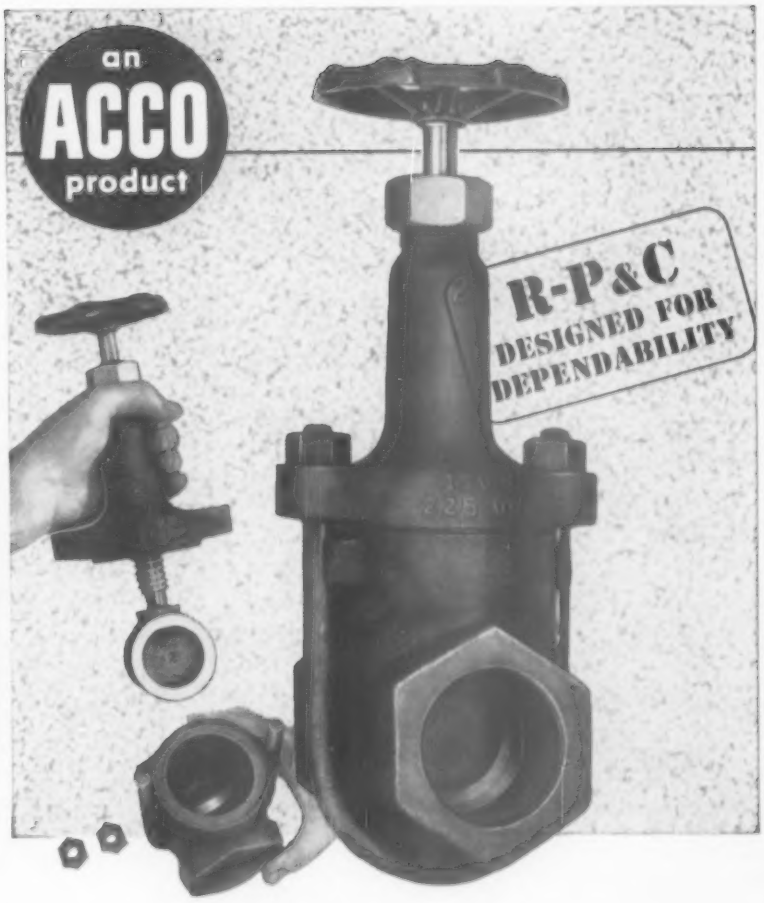
Fig. 1.

ing dolly with telescoping legs and a ball bearing assembly to hold the pipe. The legs can be easily adjusted for the proper height for the work going on. The bearing assembly mounted in the center has two large ball bearings resting in nest of smaller balls. With this kind of bearing support, the pipe can be "endoed" (moved endwise) with a minimum of effort.

Fig. 2 shows collapsible legs which can also be adjusted for height. These

Fig. 2.

horses, which hold up the end of the pipe racks, are made from angle iron and 2-in. pipe with a chain link on the bottom. One leg has two pieces of angle iron and the other one has one heavy piece. Thus they will fold together and lay flat on a truck bed when being carried from one job to another. The chain length can be varied to change the height of the support.



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Among the
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Dee Ray Drilling Co. has a new wildcat operation under contract for Halbert, Jennings & Simic in Weston County, eastern Wyoming. Location is at Texas Co.-Federal, in 4-43n-63w, about 15 miles northeast of Clareton. It is south of Mush Creek field.

Miller & York, Bakersfield, Calif., have a new deep wildcat operation under way 3 miles southwest of Riverdale, in south-central Fresno County, northern California. It is a contract job for Geochemical Surveys at 47-4 Graeber-Rowan, in 4-18s-19e. Hole is projected to the Eocene between 9,000 and 9,500 ft. Location is several miles south of Riverdale field.

Cardinal Drilling Co. has a rig working on a rank wildcat location 10 miles northwest of Maxbass, in western Bottineau County, northern North Dakota, on the northeast rim of the Williston basin. Drilling is for Farmers Union. Location is for 1 Stenehjem, in 15-161n-82w. It also is about 10 miles east of Mohall.

Martin Connection Works, Laurel, Miss., is putting a rig to work for Tom McGlothlin and associates in a new development program in the graben area separating the east and west segments of Eucutta field, in Wayne County, eastern Mississippi. First test is 1 Clark, in 12-9n-9w. It is projected to 5,300 ft.

Kirkwood & Morgan, San Antonio, have a rig on a wildcat location 2 miles northwest of Carrizo Springs, in northwestern Dimmit County, Southwest Texas, where they are drilling on contract for L. D. Ormsby and associates. Their operation is at 1-A Eva Williams.

S. H. Howell is contractor on a new wildcat operation Selby-Walker Corp. is starting 3½ miles southwest of Corpus Christi, in Nueces County, South Texas. Location is listed as 1 Mary Simcik.

Mustang Drilling Co., Tyler, Tex., is under contract for a 6,100-ft. test to be drilled for W. M. and A. P. Fuller at a wildcat location in Rowland M. Box Survey, 12 miles southwest of Elkhart, in Anderson County, East Texas. Location is on the operator's Red Town Farms lease.

Charles Drilling Co. has a new contract operation under way for Claud B. Hamill in the recently opened South Nada area, 3 miles southwest of Nada, on the Wharton-Colorado county line, Texas Gulf Coast. It is Hamill's 2

F. M. Stevenson (left), vice president, Signal Exploration, Inc., presents wrist watches to Alton Henson (center), driller, and J. O. Franks (right), tool pusher, Signal Drilling Co., contracting affiliate, in recognition of outstanding achievement in their work. Henson's achievement was cutting 1,021 ft. of hole in an 8-hour tour on a well drilled near Sussex, Wyo. Franks award was for rig performance improvement. Presentation was at a company dinner in Casper, Wyo. Special guests included Henson's crew; W. M. Barnhart, drilling engineer; D. E. Bland, drilling superintendent; and C. E. Wright, Tulsa, president of Signal Exploration, Inc. Nine drillers and tool pushers of Signal, and Pennant Drilling, Ltd., Canadian affiliate, have received achievement awards the past year.

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Harfst, in the W. S. Delaney Survey, Section 22, a 6,500-ft. test. Location is about ¼ mile northwest of the discovery gas well.

Aylward Drilling Co., Wichita, Kans., is on a new contract job for Aurora Gas Co. in southeastern Kiowa County, western Kansas. It is a Mississippian test to 4,900 ft. Location at 1 Rezeau, in 27-29-16, is 4 miles northeast of Belvedere. It is 1½ miles southwest of Soldier Creek field.

Eggleston Drilling Co. has contracted for a 9,200-ft. test to be drilled for Sam J. Recile, New Orleans operator, in 18-6s-5w, about 2 miles southwest of the Harmony Church area, in western Allen Parish, Coastal Louisiana. This contractor also is set to drill another well for the same operator in the field. It will be at 1-C Gray, an 8,500-ft. well, offsetting to the southeast the operator's 1 Gray, completed 2 weeks ago.

Penrod Drilling Co., Shreveport, is getting ready to drill a projected 16,000-ft. wildcat test in Lake Pelto, in the coastal marsh region of Terrebonne Parish, Louisiana. It is a contract operation for Lamar Hunt. Location is about 2 miles southwest of production in Lake Pelto field. Penrod also will drill a 12,000 ft. wildcat 2 miles northeast of Woodlawn field, Jefferson Davis Parish, in southwestern Louisiana. This job is for H. L. Hunt at 1 Lawrence, in 32-8s-5w.

Field Drilling Co., San Antonio, is drilling for W. Earl Rowe at a wildcat location 6½ miles southeast of Alice, in Jim Wells County, South Texas. Location is listed as 1 R. H. Richardson.

Frio Drilling Co., San Antonio, has a new contract operation under way 7 miles northwest of Sinton, in San Patricio County, South Texas. It is a 6,000-ft. wildcat test for Pontiac Refining Corp., at 1 Cockerham. Location is in Section 18, George H. Paul Subdivision.

Woolf & Magee, Tyler, Tex., will drill a 4,500-ft. Wilcox test for Nebo Oil Co., Inc., Dallas, at a wildcat location, 49 Nebo Fee, about 1½ miles west of Nebo field, in LaSalle Parish, East Central Louisiana.

Milton Crow, Inc., Shreveport, has a rig under contract to Ashland Oil & Refining Co., of Oklahoma City, at a wildcat location 1 mile south of Sandy Bend, in Union County, Arkansas. It will be a 5,000-ft. Cotton Valley test. Listing is for 1 Canady, in 25-18s-13w. Location is about 1½ miles south of production at Sandy Bend.

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John W. Walthour, district superintendent for Cities Service Oil Company, studies pumping action of Bethlehem X Mayari string at Livingstone No. 6 Well, in Bowlegs Field.

They're Pumping With X Mayari Rods in Livingstone No. 6

The Livingstone No. 6 Well, operated by Cities Service Oil Company, is located in the Bowlegs Field, four miles or so from Seminole, Okla. The 4110-ft well is a steady producer, and is currently pumping 90 bbl of total fluid daily from the Wilcox formation. About seven barrels of this production is oil, due to the high water content of the fluid in the Bowlegs area. The well has a tapered sucker rod string, made up of 3100 ft of ¾-in. and 1000 ft of ⅞-in. Bethlehem X Mayari Rods.

The Bethlehem X Mayari Sucker Rod is ideal for heavy-pumping duty because it is carefully made of a special grade of nickel-chromium-molybdenum alloy steel. The rod is normalized to obtain uniform mechanical properties, and is furnished with carburized, hardened-and-ground A4615 steel couplings.

In addition to the X Mayari Rod, Bethlehem produces four other types of carbon and alloy rods, to enable operators to better meet varied pumping conditions. We also manufacture a full line of rod accessories. For full details, check with your Bethlehem sucker-rod distributor. Or write to the Bethlehem sales office nearest you.

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B. Convert any such Rotary Hose damaged by accident to such an extent that it cannot reasonably be made useable thereafter as Rotary Hose into as many vibrator hoses as possible, free of charge to the customer except for necessary additional couplings and freight to and from the specified plant.

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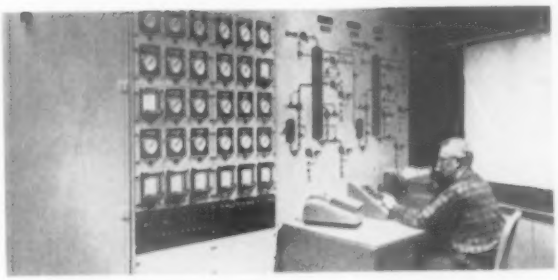
by Dan B. Miller



Trans-Scan-Log Coordinates Data

A new scanning and logging system is a compact intelligence center which coordinates all related process data, enabling the operator to instantly visualize, evaluate, and act upon every processing irregularity as it occurs, without leaving his desk. The Trans-Scan-Log system, compactly summarizes all processing data on a section of graphic panel and an adjacent panel of miniature indicating and recording receivers.

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Point scanning is continuous at the rate of one point per second and a signal light glows (white for normal; red, above normal; and amber for below normal) to indicate the point being scanned and the condition existing. Scheduled point logging can be set for every hour, half-hour, or as often as desirable.

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New stem design allows handle to be placed in any of eight positions and gives greater strength and convenience in installation and operation. **For more information write or call: Rockwood Sprinkler Co., 38 Harlow Street, Worcester 5, Mass.**

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Tex-Heater Heats 70 Bbl. Of Crude Oil Per Hour

A new portable hot-oil heater, called the Tex-Heater 25M, for oil-field production work is designed to heat 70 bbl. of crude oil per hour, to speed up the process of treating oil in field storage tanks, to clean paraffin out of flow lines and to heat oil for pumping high pressure into oil-well formations. It may also be used to blend heavy crudes with lighter oils in pipeline service and act as a preheater for heavy crude oil.

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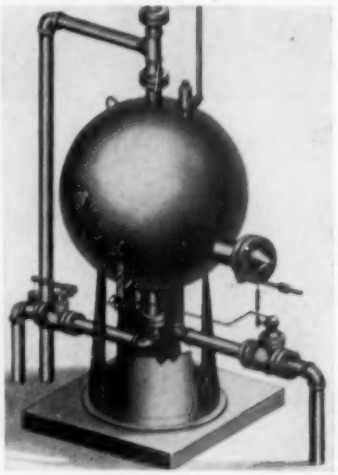
This is accomplished by air-atomizing the crude oil forced through a fuel nozzle. This is an important feature; it eliminates the costly work of hauling regular fuel to isolated oil fields. The unit is also being made to burn natural gas, propane, and regular fuel oils.

One 15-hp. prime mover drives the hot-oil heater's heavy-duty circulating oil pump, which develops 200 psi., forced-draft blower, constant-spark magneto, air compressor, and fuel-oil pump. Various types of gasoline engines may be used and fitted with electric starters.

This new hot-oil heater puts out 2,500,000 B.t.u. per hour when full on. Hot gases from the fire wipe over and around a steel-tube coil and effectively transfers the heat to the oil as it is pumped through the coil at a constant rate of 70 bbl. per hour. The oil temperature may be easily regulated between 200° and 300°.

After the unit has been started by turning on the manual fuel control, the fire is automatically modulated from one-tenth to full output by a control that turns the fuel on and off and regulates the fuel released to the combustion chamber, as needed, to heat the oil to the predetermined temperature setting. A constant ignition spark in the firepot insures proper lighting. **For more information write or call: Texsteam Corp., 320 Hughes Street, Houston 11, Tex.**



Separator Gets Maximum Separation, Minimum Drop

The Model OGS spherical separator offers economical field separation of oil and gas. Designed for well-stream hookup in any direction with top and bottom connections, the OGS is a compact unit with convenient-access openings. The outlet gas piping passing through the center of the liquid section helps maintain the liquid above freezing temperature.

Utilizing full advantage of spherical characteristics, the spherical separator achieves maximum separation at a minimum drop. Liquid slugs are diverted rapidly to the liquid section. The large ratio of liquid surface area to liquid volume allows the rapid release of solution gas. Sizes are available in working pressures ranging from 125 to 2,000 psi. **For more information write or call: Black, Sivalls & Bryson, Inc., Product Information Department, 7500 East 12th Street, Kansas City 26, Mo.**

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New Tower Packing Increases Throughput

A new tower-packing material increases efficiency of distillation, absorption and stripping. The new material is called Spraypak and its use can increase throughput 2 to 3½ times that of existing bubble-tray or ring-packed towers. Spraypak was developed by the Atomic Energy Research Establishment for the large-scale separation of hydrogen isotopes by the distillation of water. Because of the low value of the separation factor for this system, 1.026 at 100° C., the primary requirements were a very large capacity H.E.T.P. values of 2 ft. or less which are substantially independent of the diameter, and low cost. Spraypak fully meets these requirements and is now available for general industrial

use for distillation columns, absorbers, and similar applications.

In large towers, Spraypak is assembled in the form of interlocking horizontal diamond-shaped cells placed adjacent to and over one another. The walls are made of special expanded metal. In this manner a cellular structure is formed so that liquid passing down the column flows as a thin film along the walls of the cells into the trough between adjacent units. Liquid mixing occurs at this point, with the small pool of accumlated liquid dividing and flowing down the mesh to the next lower cell. Rising gas or vapor passes through the louvered holes in the expanded metal, which are similar in shape to venturi openings, so that

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intimate spraying action occurs between the descending liquid film and the rising gas. Because venturi openings cause maximum mixing at minimum permanent pressure loss, Spraypak offers low resistance to flow. This feature maintains effective contacting action down to 40 per cent of the design loading and gives Spraypak a flexibility approaching that of many tray designs. **For more information write or call: S. Blickman, Inc., Weehawken, N. J.**

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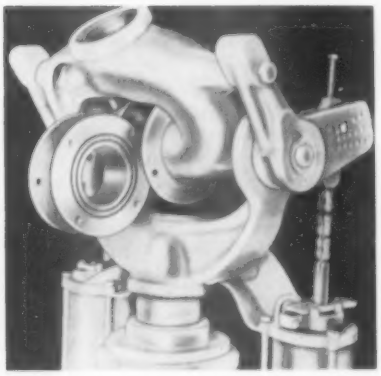

Swing Joint Designed for Reduced Repacking Time

Swing joint No. 856, a new redesigned swing joint, features reduced repacking time, tapered roller bearings, and friction-free load capacities. This new fixture is a component part of two newly developed loading assemblies, Nos. 451 and 461, and other hydraulic and mechanical spring-balanced loaders.

The O-ring seals in these joints operate against heavy, smoothly machined, bronze surfaces to insure protection against leakage, corrosion, and wear. They are equipped with Timken tapered roller bearings to give positive alignment, to prevent lateral and radial movements within the bearing, and to sustain greater load-handling ability. This improved device may be applied and connected with any and all Oilco loading assemblies. **For more information write or call: Oil Equipment Manufacturing Co., 3100 Vermont Avenue, Louisville 11, Ky.**

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Map-Guide Template Speeds Well Spotting

This Map Guide Template is simplified in design and is made on transparent vinyl plastic of 0.030-in. thickness with red lines and red printing on the front. It represents any standard

Oil and Gas Journal Showcase ..... OF NEW EQUIPMENT

surveyed section of land 1 mile square, complete with land line divisions down to 10-acre quarters. The center of each 160-acre and 40-acre quarters are designated as to their proper legal description. The NW designating the northwest quarter (160 acres) of a section, and NW NW as the northwest quarter of the northwest quarter of a section. In addition, there are circular holes at the surveyed center point of each 160, 40, and 10-acre quarters of a section. These holes make it possible to plot the center points on a map.

There is a vertical and horizontal scale on the left-hand side and the bottom of the template. The two scales are the same scale as the template, thus making it easy to plot any surveyed locations other than the center points of a section. It can be used for spotting well locations, surveyed land descriptions, and legal property descriptions. The template makes a practical guide to check existing plotting on maps and plats and an orientation guide of legal descriptions. It is available in six scales ranging from 1 in. = 1,000 ft. to 2 in. = 1 mile. **For more information write or call: E. R. Marshall, Jr., 765 Ukiah Way, Upland, Calif.**

●

Dynagraph Analyses Sucker-Rod Performance

Problems of sucker rod load and perfomance can now be graphically analyzed by the Bowlus-Technical dynagraph. It embodies a number of factors making it highly suitable for oilfield operations. Its light weight, 29 lb., makes it easy to set up under any field conditions. One instrument is suitable for any size of polish rods. Overall simplicity makes for trouble-free operation. It is adaptable to either mechanical or hydraulic pumping units.

Technical Service Co. will provide dynagraph service to interested operators or will sell individual instruments outright. Combined with a dynagraph survey, this log provides a very complete picture of the efficiency of pumping operations. **For more information write or call: Technical Service Co., 3504 Atlantic Avenue, Long Beach 7, Calif.**

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OIL AND GAS JOURNAL

Showcase

- BULLETINS
- CATALOGS
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Clarifiers and Thickeners. Questions on design requirements of clarifiers and thickeners for a wide range of capacities and solids removal loads are informatively answered in this 16-page, easy-to-read, graphically illustrated Bulletin W-800B-S-6000B. The bulletin explains why circular sedimentation basins, sludge scrapers, and central inlet wells are features of Infilco clarifiers and thickeners. **For more information write or call: Infilco, Inc., Tucson, Ariz.**

●

Desiccant Type Dryers is a new 40-page bulletin, D-100, on the complete line of desiccant type dryers for drying air, gases, and liquids. The bulletin explains the 26 principle variables of dryer design and the effects temperature and pressure have on the size of dryer needed for specific applications. Design features and principles of operation are explained, and a complete series of selection charts enables the reader to select the dryer that will exactly suit his conditions and needs. **For more information write or call: C. M. Kemp Manufacturing Co., 405 East Oliver Street, Baltimore 2, Md.**

●

Flexible Ball Joint Catalog. A new 20-page catalog, 215-B, on flexible ball joints lists many industry applications which highlight the versatility and economy of the ball joint. Basically, the flexible ball joint is similar to a ball and socket as to movement. Two molded or metal gaskets provide the leakproof seal. This design permits the advantage of movement in all planes in a single joint from 30° to 40° angular side flexing, plus 360° slow rotation. Three or possibly four ball joints will provide unlimited flexibility in any plane, any angle, and any radius. Barco flexible ball joints are available for working pressures to 4,500 psi. and temperatures to 1,000° F. Fifteen different sizes are cataloged from ¼ to 12 in. Six standard materials are offered with specials available on order. **For more information write or call: Barco Manufacturing Co., 501 North Hough Street, Barrington, Ill.**

●

Standard Conversion Tables. A new 16-page bulletin, F7255, gives thermocouple temperature - millivolt equivalents. Temperatures are expressed on the International Temperature Scale of 1948. The electromotive force is expressed in absolute units. Instrument men will find this literature convenient reference material. **For more information write or call: Barber-Colman Co., Wheelco Instruments Division, Rockford, Ill.**

●

Hard-Surfacing Alloys. These materials consist of alloy-filled tubes, either in coils for automatic welding or cut to length for manual application. The alloys and methods of their manufacture were developed through 2 years of research and field test, to meet the growing demand for higher alloy hard surfacing at low prices. **For more information write or call: Coast Metals, Inc., Little Ferry, N. J.**

●

Tubular Products. Engineers and designers associated with the applications of tubular products in the process industry should be interested in this new folder, TB-408. This eight-page folder

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EQUIPMENT MEN

contains a complete listing of the type of tubing produced by the company and a brief description of various kinds of technical literature available on such specific types of tubular products as stainless and alloy tubing, stainless pipe, heat-exchanger and condenser tubing, boiler tubing, and mechanical tubing. In addition, it contains a table of chemical analyses, physical properties, mechanical properties, and creep strength of 20 steels ranging from carbon steel through the stainless steels. **For more information write or call: Babcock & Wilcox, Tubular Products Division, Beaver Falls, Pa.**

●

Hydraplex Hooks Bulletin BJO-778 sets out the outstanding features of the heavy-duty line of hooks that are designed with shock-absorbing snubbers for smooth action when handling longest strings. The cushioning action prevents damage to tool joints and reduces rig maintenance. The hook positioner, available as optional equipment, is a time-saving accessory. The Hydraplex line is available in five sizes, with capacities from 100 to 450 tons. **For more information write or call: Byron Jackson, P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.**

●

Refractory Concrete. This 55-page book contains 10 graphs showing compressive strength, refractoriness-under load, stability curve, thermal expansion, thermal conductivity, temperature gradients for furnace hearths and outside walls, and three additional methods of determining refractoriness-under load. It also covers applications of higher refractories such as chrome, chrome magnesia, fused alumina, and sillimanite. **For more information write or call: B. E. Evans, Lafarge Aluminous Cement Co., Ltd., 73 Brook St., London, England.**

●

Hydraulic and Air Components. A new Catalog No. 555, with 36 pages and cover, fully describes the services and products of the company. Features, specifications, and applications of pumps, cylinders, jacks, braces, and other units are attractively presented. **For more information write or call: Star Jack Co., Inc., 420 Lexington Avenue, New York 17, N. Y.**

●

New Data Sheet on Multi-V Belts. A data sheet on a line of multi-V belts, featuring the patented grommet construction, covers BFG grommet V belts, high-capacity grommet V belts, high-capacity static-conducting belts, oil-resisting V belts and double-V belts. Grommet belts have all the load-carrying cords concentrated in twin grommets, or cord loops, made like giant twisted cables except that they are endless. Standard grommet belts are said to last 20 to 50 per cent longer than conventional belts. The more severe the service, the greater the advantage of the grommet construction. **For more information write or call: B. F. Goodrich, Industrial Products Division, Akron, Ohio.**

●

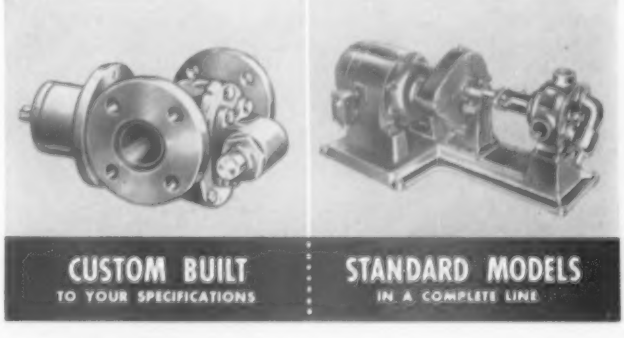
Petroleum Distillation Apparatus. Bulletin 716 describes front-view distillation units for petroleum products. This four-page illustrated brochure discusses construction and operational features of the various models offered; the ice water, and mechanically refrigerated units, each in several sizes, with particular emphasis on the Lo-Cap heater, a new heating unit, the low mass of which affords rapid heating and cooling, assuring instantaneous response. **For more information write or call: Precision Scientific Co., 3737 West Cortland Street, Chicago 47, Ill.**

●

New Transmitter for Closed Tank Level Measurement. A new eight-page Bulletin 13-22, describes closed-tank liquid-level measurement and control with the recently announced Type 13 LA d/p cell liquid-level-transmitter. The Type 13 LA is essentially the same as the familiar force balance differential pressure flow transmitter, except that a simple range-suppressor spring has been added to the basic mechanism. The spring balances out the effect of hydrostatic pressure in the line from the high point of the tank. Among the features emphasized is installation simplicity. Only two small pressure taps are required in the tank, with direct connection by ½-in. pipe to the high and low-pressure sides of the cell. **For more information write or call: Foxboro Co., Foxboro, Mass.**

●

Vertical Oil and Gas Separators, a data sheet, perforated for loose-leaf binding, features a flow diagram showing the tangential inlet, ceramic-saddle mist extractor, fluid-stabilizer plates, and positive-control Kimray valves. The high foam capacity of the unit results from stabilizer design and position. Agitation is eliminated as oil is conducted from lower-stabilizer plate and discharged, below fluid level, in the accumulator compartment. **For more information write or call: Sivalls Tanks, Inc., Box 1152, Odessa, Tex.**



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EQUIPMENT MEN . . . in the News

Wisconsin Motor Appoints Assistant Sales Manager

TOM BARRETT

The appointment of Tom Barrett as assistant sales manager for Wisconsin Motor Corp., has been announced by Ray J. Fellows, sales manager. Barrett has served as sales representative for Wisconsin Motor Corp. for the past 7 years and is well known to the company's manufacturing customers and distributors. Barrett will team up with Assistant Sales Manager Will Perschbacher to assist Fellows in the further promotion of sales and distribution of Wisconsin heavy-duty air-cooled engines in the domestic market.

Mission Shifts Brown and Harrison to England

W. N. Brown, design engineer, and J. D. Harrison, Jr., technical assistant, for Mission Manufacturing Co. are being transferred to Mission Manufacturing Co., Ltd., of England to help supervise the setting up of the new Mission plant in Belfast, Northern Ireland. They plan to be in Ireland about 6 months.

Brown and Harrison will work under the direction of R. H. Anschutz, manager of the United Kingdom Co., and liaison between the Houston and British plants. Brown will be generally responsible for getting the plant in operation, and Harrison will supervise the tooling and inspection phases.

Thompson Made President Of Tulsa's First National

R. Elmo Thompson, long-time Oklahoma banker and former oil company executive, has become president of the First National Bank & Trust Co. of Tulsa. Thompson succeeds R. Otis McClintock, also a veteran banker and well known to the oil industry. First National president for 27 years, McClintock was elected chairman of the board of directors, replacing Fred L. Dunn, who retired.

In other top changes, E. F. Allen, executive vice president, was named vice chairman of the board and chairman of the executive committee; Russell F. Hunt was advanced from vice president and assistant to the president to executive vice president and was elected to the board; and J. P. Byrd, Jr., senior vice president, was given the additional title of assistant to the board chairman.

Schlumberger Announces Recent Personnel Transfers

Schlumberger Well Surveying Corp., Houston, has announced recent personnel transfers and promotions in Canada.

L. G. Chappell, formerly eastern division manager at Regina, has been moved to Edmonton as manager of the western division. He will be assisted by W. W. Shoquist, who has moved to Edmonton from the Calgary district. L. V. Carson will replace Shoquist as manager of the Calgary district.

B. M. McVicar is the new manager of the eastern division, replacing Chappell. He was formerly assistant to the area manager at Calgary. W. T. Wilson, formerly district manager at Virden, has been transferred to Calgary to succeed McVicar.

A. H. Dorin, who was formerly station manager in Kindersley, has been promoted to district manager at Virden. W. B. Anderson has been appointed to replace Dorin in Kindersley.

Cooper-Bessemer Makes Salls Home Office Manager

D. M. SALLS

The appointment of David M. Salls as home office manager of the gas and oil industry sales-engineering section has been announced by R. F. Lay, vice president and sales manager of Cooper-Bessemer Corp., Mount Vernon, Ohio. In his new position Salls will be responsible for coordinating the efforts of the home office engineering group directly supporting Cooper-Bessemer's field sales activities in the oil and gas industries.

Salls joined Cooper-Bessemer in 1941 and later became associated with Texas Eastern Transmission Corp. as a mechanical engineer. Since his return to Cooper-Bessemer in 1951, Salls has headed various engineering programs undertaken by the company for the oil and gas industry.

Great Lakes to Offer Electric Wireline Service

J. T. HANCOCK

A new corporation, Great Lakes Petroleum Services, Inc., with main offices in Houston, has recently been organized as a wholly owned subsidiary of Great Lakes Carbon Corp. of New York City. J. T. Hancock, Jr., is president of the new corporation; R. W. Smith is vice president, manager of sales; and L. W. Toelke is vice president, engineering and development.

R. W. SMITH

L. W. TOELKE

The new corporation's objective is to furnish to the oil industry various improved electric wireline services, such as perforating and gamma ray-neutron logging. The first perforating and logging units are now being developed and built in Houston and should be completed about February 1, 1956.

Reed Roller Bit Co. Opens Denver Office

T. R. CHILDS

Reed Roller Bit Co. opened a Denver office December 15 under the direction of T. R. Childs, Jr. "Growing importance of Denver as an oil center makes this office necessary," said W. L. Childs, Jr., sales manager of the oil-tool manufacturing firm.

T. R. Childs, Jr., who will head the Denver office, has been with Reed since 1944. He served as district salesman in West Texas before being reassigned in this capacity to the Rocky Mountain area in 1951. He was stationed in Grand Junction, Colo., before his transfer to Denver.

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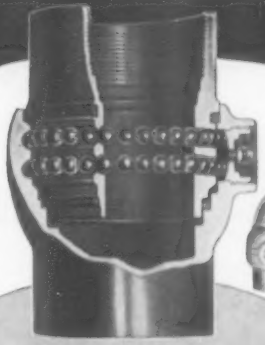

No. 80
No. 80F
No. 10
No. 10F
No. 70FX5
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FULL UNRESTRICTED FLOW • EFFORTLESS MOVEMENT
GREATER LOAD CARRYING CAPACITY • "O" RING SEALED
CONTAMINATION FREE OPERATION • PERFECT ALIGNMENT

The wide range of sizes and styles of OPW BALL BEARING SWING JOINTS offers many and varied applications for safely handling liquids of diversified viscosity at required temperatures and working pressures.

Millions of gallons of all types of liquids are moved daily in flow lines where perfectly sealed, rotating OPW Swing Joints provide an almost limitless range of flexible operations.

Join other users of OPW Swing Joints. You can also realize economies in your liquid products handling.

Free Catalog F-8
provides engineering data, sizes, styles, recommendations and prices.

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Rigid quality controls assure top field performance with UNAFLO*

In every bag of Unaflo Oil-Well Cement you get full measure of uniform, dependable field performance. That's because Unaflo is manufactured under rigid quality controls. Careful testing in the laboratory and during manufacture maintains *consistent* high quality. Trained technicians test samples from shipments to assure proper well-bottom performance.

Oilmen know that this consistent quality means more reliable performance and helps to protect their investments in the field. In emergencies, they're sure of vital extra time because of Unaflo's *retarded* set. And Unaflo slurries pump easily right from the start . . . stay fluid under critical conditions of temperature and pressure. Yet after the retardation period, Unaflo slurries form a strong, tight, sulphate-resistant seal. The name Unaflo is your assurance of high quality and dependable performance. When you're drilling deep and cementing slurries *must* go in place without a hitch, be sure to specify Unaflo Oil-Well Cement.

FOR YOUR CONVENIENCE, we have just compiled a new series of 6 months' average test results for Unaflo's thickening time and compressive strength. All tests are made according to the latest API Recommended Practice for Testing Oil-Well Cements. For your copy of this up-to-date, authoritative data, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

*"UNAFLO" is the registered trade-mark of the retarded oil-well cement manufactured by Universal Atlas Cement Company

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Resistant to Sulfate Waters
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EXPLORATION

New Look in West Texas?

by Norman S. Morrisey

IS the Permian basin acquiring a new look? Recent well data make it appear so, particularly along the flanks of the Central Basin uplift. The significance of thrusting and its role in forming oil traps is becoming more and more apparent. Thrusting increases the number of oil traps in an area and adds to the oil possibilities rather than detracts.

Permian sediments do not reflect accurately the complex pre-Permian geology along the Central Basin platform. However, some geologists consider that a series of normal fault blocks exist on each flank of the uplift. Wells that have drilled vertical beds or repeated sections are classed as "abnormal" since this theory fails to explain them satisfactorily.

But let's look at some of the producing fields.

- Wells at Keystone have drilled normal sediments on the west flank of the field and then cut a reverse fault, repeating some of the overlying beds.
- At Payton, the first deep test drilled a normal section to the top of the Simpson; then it entered steeply dipping Simpson beds and was plugged back before reaching the Ellenburger. The Ellenburger discovery, on a more favorable location on the overthrust or overturned fold, found normal sediments and was completed as a gas-distillate well for 12.5 million cubic feet of gas per day plus 50.7 bbl. of distillate per million feet of gas.
- Many other Ellenburger fields are asymmetrical anticlines with very steeply dipping beds on one flank. Although the thrust fault has not been penetrated, the possibilities are excellent that some type of faulting exists.
- Wells on the Dora Roberts trend on the east side of the Central Basin platform have passed through a thrust fault and repeated formations.
- Reverse or thrust faulting occurs at Todd Deep field in Crockett County where a well repeated part of the Simpson and then entered the Ellenburger for the second time.

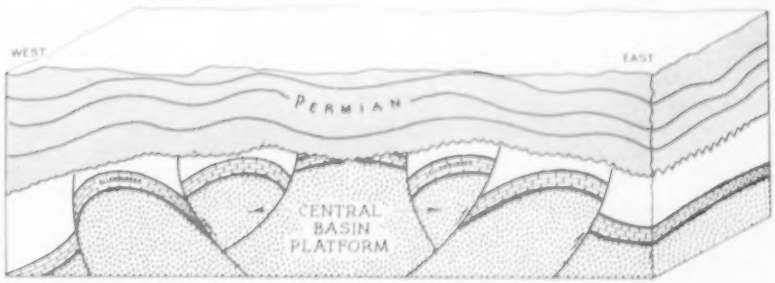
Thrusting in two directions . . . At first glance it is difficult to realize that thrusting can occur on both flanks of a major unlift like the Central Basin platform. But Griggs (Amer. Jour. Sci. 1939, p. 611) showed by laboratory experiments that thrusting can take place on both flanks of a mountain uplift. And Link, in 1928, had recognized the importance of this phenomenon.

In a recent Journal article this regional concept was extended into the field of oil finding and the article showed that thrusting can occur in two directions on local anticlines (*The Oil and Gas Journal, May 16, 1955*). These theories may help to explain why certain West Texas fields are asymmetrical on the east flank, but others in the same general area have a steeply dipping west flank. They also may explain why thrusting occurs on both sides of the Central Basin uplift.

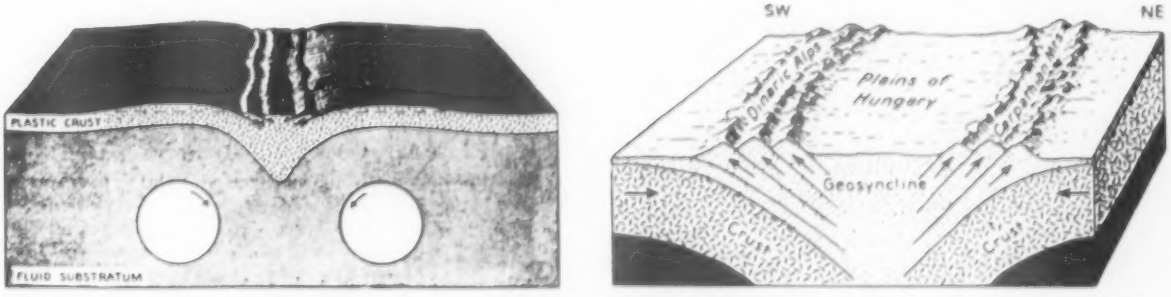
More oil traps . . . Widespread thrusting will increase the number of oil traps in West Texas. Invariably in a thrust area, the folds line up along easily recognized trends that extend for many miles. A glance at some of the Appalachian folds supports this conclusion. Local highs or closures along such West Texas folds can mean more Ellenburger production. Thus it is possible to extend known trends by careful seismic exploration. The Dora Roberts-Headlee line of folding is a good example of this type of structure where production is found along an 18-mile trend.

Thrusting involves headaches for geologists because of the complexities in thrust areas. At the same time, it is in the complex areas that much of our future oil lies. Flank production on large anticlines, for example, may be compared to flank production on salt domes. At first the crest of the dome was developed, then the oil companies discovered the prolific fault traps on the flanks.

The same history may repeat itself on the large West Texas folds.



Here's how the Central Basin platform may fit Griggs' theory. The buried thrust blocks are concealed by the Permian sediments.



Griggs showed by laboratory experiments (left) that convection currents within the earth's interior can cause major uplifts that are bounded by thrust faults. The deformed geosyncline forms a horst, or wedge like the Plains of Hungary (right).

Tide Water holds longest deviated hole to within fifty feet of true

"K" Monel Collars *accurately bottom 14,128 ft. well having 3340 ft. offset*

This is the story of Houma I Community . . . the well with the longest deviated section ever drilled. Bottomed under Houma, Louisiana, from a location at the city limits, it was drilled for Tide Water Associated Oil Company, using a steam rig.

The first whipstock was set at 1,018 ft. At approximately 2000 ft. the 20° drift angle was obtained and maintained closely to 3000 ft. Below that the drift angle was permitted to fall off to about 18°. From 11,000 to 12,400 ft. the hole was gradually straightened and from 12,400 to the bottom the angle was less than ½°. Ten whipstocks were used in all.

From top to bottom, the hole is contained within a pre-planned 50-ft. radius tract.

Drilling hook-up

To build angle, the drilling contractor hooked up a bit, stabilizer, and 4½ in. Servco "K" Monel* (age-hardenable, nickel-copper alloy) pup joint with 4½ in. drill pipe.

To reduce rates of change in angle or direction, he replaced the pup joint with a 20 or 25 ft. Servco "K" Monel alloy drill collar. To hold rates constant, he simply added two steel collars above the "K" Monel unit.

To reduce drift angle and regain vertical he removed the stabilizer, leaving collars in the string.

"K" Monel prevents survey errors

Because the "K" Monel collar equipment is iron-free and permanently non-magnetic under oil well drilling conditions . . . and because it isolates the instruments from magnetic influence of the string . . . survey readings are accurate. Hidden errors don't creep in.

What's more, "K" Monel stands up. It's stronger than steel; corrosion-, wear-, and abrasion-resistant.

When you drill directionally, use "K" Monel alloy equipment. It pays.

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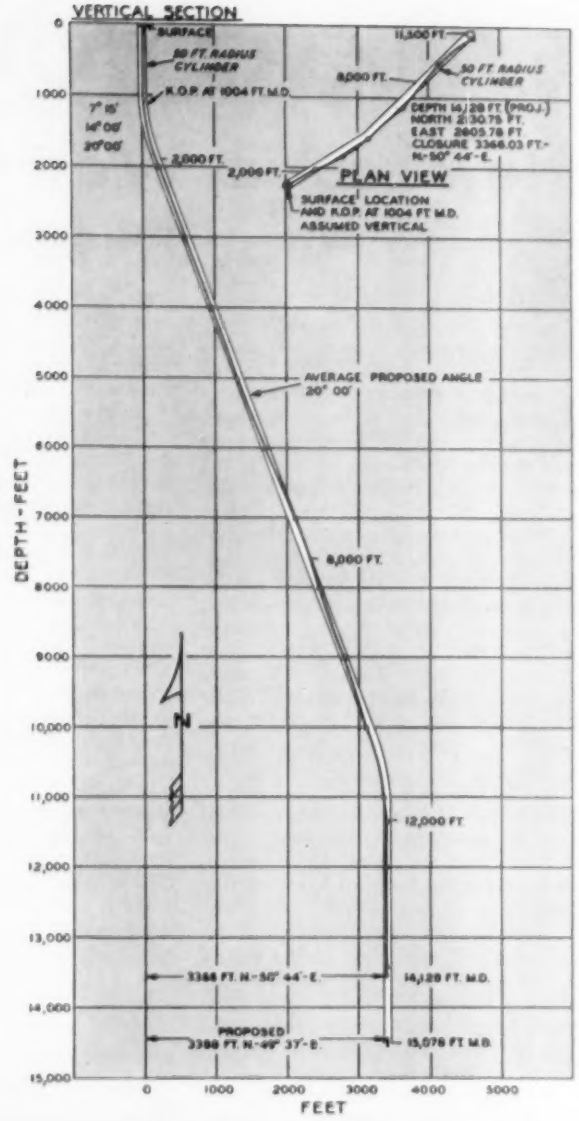
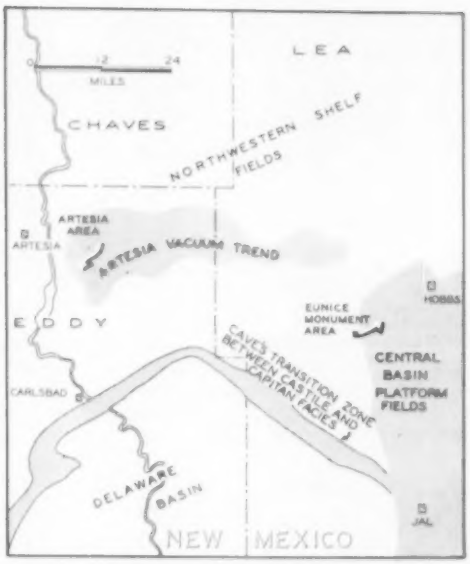


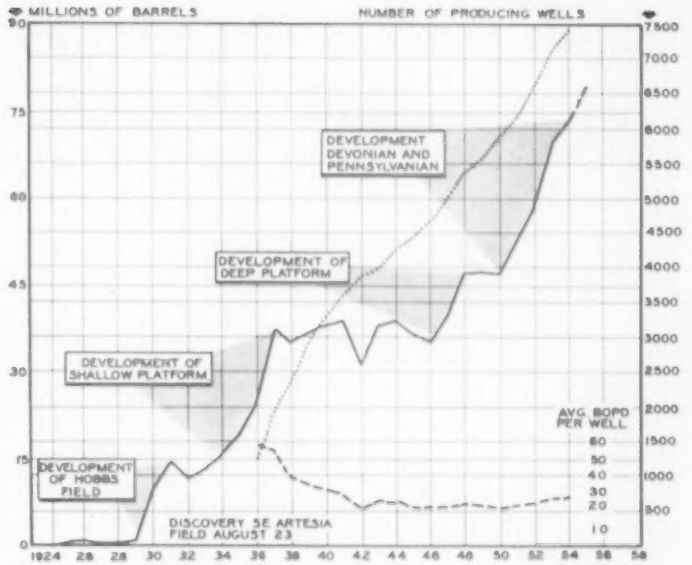
Degree of directional control obtained with "K" Monel drill collars is shown in this section and plan of Houma I Community. Notice how well was held within the 50-foot radius tract planned.

Houma I Community bottoms 14,128 feet under the city from this location 3340 ft. away at the city limits.

INCO "K" Monel . . . *for non-magnetic drill collars*



PRODUCING areas in Eddy and Lea counties.


MILLIONS OF BARRELS
NUMBER OF PRODUCING WELLS
DEVELOPMENT DEVONIAN AND PENNSYLVANIAN
DEVELOPMENT OF DEEP PLATFORM
DEVELOPMENT OF SHALLOW PLATFORM
DEVELOPMENT OF HOBBS FIELD
DISCOVERY SE ARTESIA FIELD AUGUST 23
AVG BOPD PER WELL

TREND toward deeper production has been steady since 1946.

Here's a quick roundup of

Southeast New Mexico's Oil Potential

SOUTHEASTERN New Mexico now has more exploration drilling in progress than ever before, and is consistently one of the most active areas in number of drilling wells and geophysical crew weeks in the nation. The recent trend of oil producers establishing exploration offices in New Mexico is a significant fact. Recent discoveries, and the extension of numerous fields in the Guadalupe series, has again focused attention of operators on these horizons. The deeper horizons of the Northwestern Shelf are being developed at a rapid rate.

Under much of southeastern New Mexico, there is a thick section of potential oil and gas-bearing sediments. With the extensive exploration work that is now being carried on, numerous new fields are sure to be discovered in southeastern New Mexico.

Oil and gas-producing areas in southeastern New Mexico are within the Permian basin, which is further subdivided by major structural units into the Delaware basin, Central Basin platform, and the Northwestern Shelf.

Most of the production comes from Permian rocks, although such geologically older formations as the Devonian, Siluran, and Ordovician are becoming more important.

This resume of oil and gas-producing zones in southeastern New Mexico was presented before the New Mexico Interstate Oil Compact Commission in Santa Fe, by Randall F. Montgomery, geologist, New Mexico Oil Conservation Commission.

The Artesia-Vacuum Trend . . . This trend forms the northern border of the Delaware basin. It is an area of organic reef facies, and back-reef facies consisting of sandstones, dolomites, anhydrites, and red shales.

In this area, oil is obtained from successively younger formations southward toward the Delaware basin. Porosity and permeability development are the controlling factors in accumulations. This is attributed to the migration of the reef seaward and the accompanying migration of favorable reservoir beds.

Recovery from the reservoir is better on the eastern end of the trend. Vacuum field has the highest yield, and recovery decreases as you go westward to Artesia field. Most reservoirs in the trend are Guadalupe in age. The pre-San Andres has not been extensively developed. The Wolfcamp is productive in one well in Empire field; the Pennsylvanian has five scattered gas wells; and the Devonian is productive in one well on the Maljamar structure. The Paddock is producing oil from three wells also on the Maljamar structure.

In this trend, Vacuum field is the third largest in the state and has produced over 72,000,000 bbl. of oil. In total oil produced, the trend fields account for 20 per cent of New Mexico's oil.

Areas which have not been extensively explored are those south of the Artesia and Vacuum fields.

Central Basin platform fields . . . Hobbs field, located on the northern end of the New Mexico portion of Central basin platform, is the state's second largest field in accumulated production. After 28 years, the field is still being developed and 70 per cent of its wells are still flowing. Recovery in Hobbs field has exceeded 13,000 bbl. of oil per acre.

The Eunice High has proven to be productive in 11 horizons. Dollarhide, Monument, and Fowler have production in five formations.

For comparison, oil produced from fields on the Central Basin platform account for 67 per cent of New Mexico's total production. Fields on this trend are still undergoing extensive development.

Northwestern Shelf . . . This area is north of the Artesia-Vacuum trend. Production is mainly from the Wolfcamp, Pennsylvanian and Devonian at depths below 9,000 ft. Caprock-Queen and Lovington fields have also produced considerable oil at shallower depths.

Lithology of the Silurian and Devonian is very similar in the northern

portions of Lea County, and controversy exists as to the correct age of some of these fields. For statistical purposes, they have been considered to be Devonian in age.

Fields in the shelf area are designated as Wolfcamp, Permo-Pennsylvanian, and Pennsylvanian in age. Many consider all of these fields to be Wolfcamp, leaving Cass pool (east of Eumont area on the Central Basin platform) as the only Pennsylvanian field in New Mexico.

Most of the deeper pools of the northwestern shelf appear to be on north-south trending folds. Due to the depth factor in the state's proration formula, the shelf area is producing an ever-increasing percentage of the state's production. The fields, which account for only 12 per cent of total accumulated oil, produced 43 per cent of 1955 production to August 1, reflecting the recent rapid growth of the area.

Some wells in Denton field have in excess of 500 ft. of pay. Crossroads field has recovered over 9,000 bbl. of oil per acre, and many of the structures are productive in both Wolfcamp and Devonian.

General Geology

Structure . . . The platform is bordered on the west by the Delaware basin and on the north by the San Simon Syncline. The Guadalupe back-reef section is productive of oil and gas from the north end of the platform, extending southward into Texas.

Older Permian, Pennsylvanian, Devonian, Silurian, and Ordovician sediments are prolific reservoirs on such major structures as Monument, Eunice, and Dollarhide.

Central Basin platform was formed during late Pennsylvanian time and underwent intense mountain-building during this era. Intensity of this orogeny is indicated on the Eunice High where over 1 mile of section had been removed by erosion before the Abo formation was deposited. The Abo rests with angular unconformity on all older rocks and overlies the pre-Cambrian on the eastern edge of the Eunice High.

Pre-Cambrian . . . Basement rocks are estimated to be more than 19,000 ft. in the deeper portions of the Delaware basin. On the eastern edge of the Eunice High, basement rocks are encountered around 7,300 ft. Northward from the Delaware basin, the rise is gentle and basement rocks are about 10,000 ft. deep in northern Lea County.

Cambrian . . . No sediments of Cambrian age are identified in southeastern New Mexico.

Ordovician . . . The Ellenburger formation overlies the eroded pre-Cambrian surface, except in those areas where it has been removed by erosion. Average thickness is about 350-400 ft. and predominantly a carbonate section. The Ellenburger generally becomes thinner to the northwest.

Four fields have produced 3 per cent of the state's all-time production, and for 1955 the Ellenburger will account 4 per cent of the production. All of these fields are located on the central basin platform. Brunson is the largest producing Ellenburger field.

The McKee sandstone, Middle Ordovician, is the only producing formation in the Simpson. Six fields, all of which are on the central basin platform, have produced a little over 1½ per cent of the state's accumulative oil. The McKee will account for about 4 per cent of 1955 production.

The Montoya is Upper Ordovician in age and reaches 400 ft. in thickness in southern Lea County, but thins northward. Only three wells have been completed in the Montoya, all of which are in Cary pool on the Central Basin platform.

Silurian . . . The Fusselman is Middle Silurian in age and the Upper and Lower Silurian are not present in southeastern New Mexico. The Fusselman is productive in three fields, all of which are on the Central Basin platform. Production from these fields has not exceeded 1 per cent of the accumulative production.

Devonian . . . The Devonian is presently the object of intensive exploration work. It is a dolomite section of Lower Devonian age, becoming less dolomitic southward. During Upper Devonian time the Woodford sea transgressed upon the area, depositing a black calcareous shale which reaches 600 ft. in thickness and wedges-out along the northern border of Lea County. This formation has been removed by erosion over much of the Central Basin platform.

Now, 28 Devonian fields are producing 24 per cent of New Mexico's 1955 production. Rapid development of the Devonian fields is indicated by its having produced slightly more than 5 per cent of the accumulative production for the state. Three of the Devonian fields are on the platform, and the remaining 25 on the Northwestern Shelf.

"The Devonian is presently the object of intensive exploration work . . . 28 Devonian fields are producing 24 per cent of New Mexico's 1955 production. Rapid development of the Devonian is indicated by its having produced slightly more than 5 per cent of the cumulative production for the state."

Mississippian . . . The Mississippian "lime" is some 1,500 ft. thick and thins northward to a feather-edge. Two wells have produced 7,000 bbl. of oil from the Mississippian.

Pennsylvanian . . . Pennsylvanian sediments are primarily carbonates 1,000-3,500 ft. thick with beds of detrital shale. Many of the fields which are designated as Pennsylvanian may be Wolfcamp in age, but for purposes of this report they are considered to be as presently designated. The only field in southeastern New Mexico which is unquestionably Pennsylvanian in age is the Cass pool. The Pennsylvanian has produced about 2 per cent of the total accumulated production of the state.

Permian . . . During the Permian period, there were numerous inland embayments where circulation was often restricted and depositional environments were constantly changing. This was a period of great reef development, and as the Permian sea regressed, the reef transgressed upon the older Delaware basin deposits. Reef development reached spectacular proportions during the Guadalupian series, but was drowned out in Ochoa time by hypersaline waters. The Permian of southeastern New Mexico is a complex suite of sediments which are broadly classified into three facies: the Delaware basin facies, the reef facies, and the back-reef facies.

The Delaware basin facies is characteristic in that it is a section of thick sandstones, black shales, and black limestones with abundant fossils. This section has many of the desirable features the exploration geologist seeks—a thick section of sedimentary rocks, source beds, and wedge belts of porosity. The Permian of the Delaware basin has a sedimentary section in excess of 10,000 ft., and as to source beds, the basin abounds in organic remains. The wedge belts of porosity are present throughout the area of the reef developments.

The reef facies is characteristic in that it is a thick section of carbonates with rapid vertical development con-

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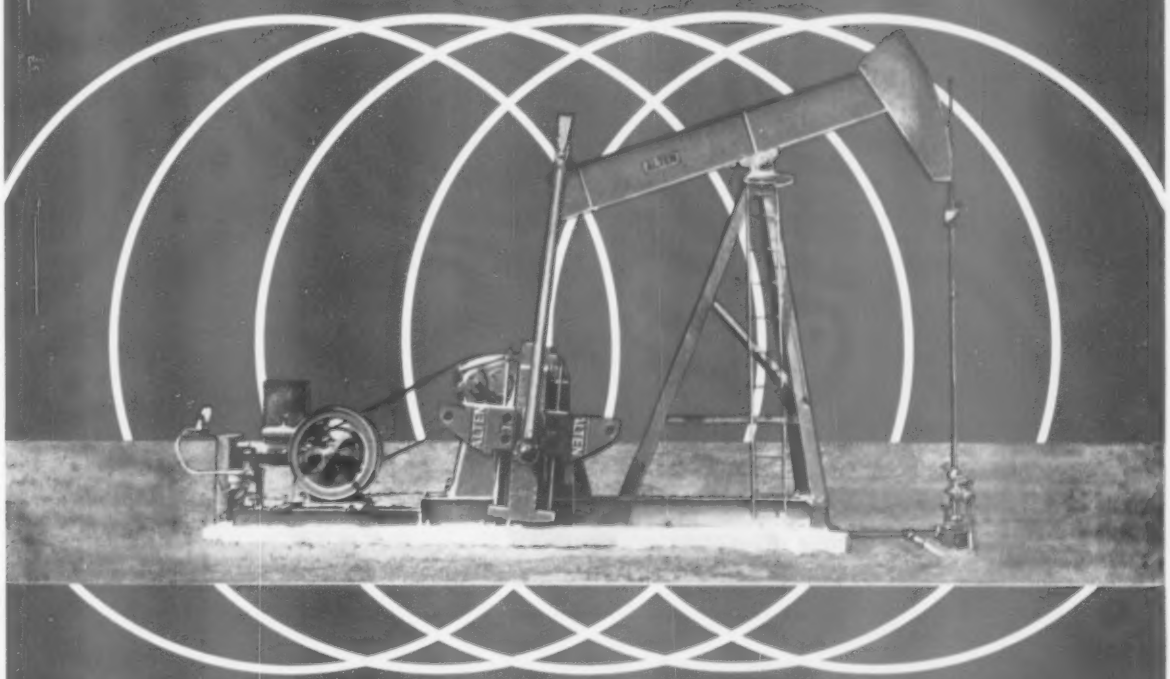

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"Due to recent development, the Wolfcamp will produce in excess of 8 per cent of 1955 production. Queen sandstones are widespread and petroliferous . . . (They have) produced over 9 per cent of the state's total oil production, and will greatly exceed that figure in 1955."

taining abundant fossils in the outcrop, with wedges of both the basin and back-reef section abutting against and into the reef.

The back-reef facies is characteristic in that it is a section of thin sandstones often red, precipitated dolomites, thick beds of anhydrite, halite, red shales, and oil fields.

Wolfcamp . . . In the Delaware basin, the Wolfcamp is a dark shale and black limestone deposit grading northward into a gray limestone. On the Northwestern Shelf, many important oil reservoirs are present such as Denton-Wolfcamp, Saunders, and Townsend fields. All of the Wolfcamp reservoirs are located on the Northwestern Shelf. Wolfcamp formations have produced about 1½ per cent of the state's cumulative production. Due to recent development the Wolfcamp will produce in excess of 8 per cent of 1955 production.

Leonard . . . The Abo is the basal formation of the Leonard back-reef section. Four fields have produced oil from the Abo formation, three of which are on the Central Basin platform, and the Lovington-Abo field on the Northwestern Shelf. The Abo has produced about ½ of 1 per cent of the state's total, but will produce in excess of 2 per cent for 1955. The basin facies equivalent is the Bone Spring formation which has produced less than 3,000 bbl. of oil from three wells.

The Yeso formation is conformable over the Abo, and contains several producing horizons. At the base is the prolific Drinkard pay. The Tubb is important as a gas-producing horizon, and the Blinebry is productive of both gas and oil. The uppermost unit of the Yeso is productive of oil in the Paddock zone. Northward, the Yeso becomes continental red beds.

The basin facies equivalent of the Yeso is Bone Spring; the reef facies is represented by the Victorio peak "lime bank." The Drinkard will produce over 5 per cent of the state's 1955 production, the Blinebry almost 2 per cent, and the Paddock 3 per cent. The Yeso formation has 19 producing fields.

Guadalupe series . . . The production from the Guadalupe series accounts for 79 per cent of the state's accumulative production. Formations of the Guadalupe series will produce in excess of 40 per cent of the state's production for 1955.

It was during the Guadalupe series that the Permian reefing reached such spectacular proportions. The following is a correlation chart of the Guadalupe series:

Back-Reef Facies	Reef Facies	Basin Facies
Tansill	Capitan	Bell Canyon
Yates	Capitan	Bell Canyon
Seven Rivers	Capitan	Bell Canyon
Queen	Goat Seep	Cherry Canyon
Grayburg	Goat Seep	Cherry Canyon
San Andres	Goat Seep	Cherry Canyon
Glorieta	Cutoff Shale	Brushy Canyon

Most of the production obtained in the Delaware basin comes from the Bell Canyon section, which has 35 producing wells. Brushy Canyon has five producing wells. Accumulative production from the Delaware basin is 0.04 per cent.

Glorieta . . . The Glorieta is a transgressing marine sand, and is productive of dry gas in the Justis gas pool.

San Andres . . . The San Andres is a thick carbonate section reaching 1,500 ft. in thickness. Only the upper few hundred feet have been proven productive. The San Andres is characteristic in that it often has cavernous porosity with an active water drive. This formation is productive of oil and gas in fields such as Eunice - Monument, Hobbs, Vacuum, and Grayburg-Jackson. The Grayburg and San Andres are often productive in the same fields. These two formations have produced in excess of 65 per cent of the state's production, from 28 fields.

Grayburg . . . The Grayburg is commonly known as the "sandy lime." As stated, it is often productive of oil and gas in the same fields as the San Andres, and is included with the tabulation of the San Andres fields.

Queen . . . The Queen is the first major sand deposition since the Glorieta, and marks the beginning of the rapid departure of the Permian sea from this area.

Queen sandstones are widespread and petroliferous, being productive on the Central Basin platform, the Northwestern Shelf, and the Artesia - Vacuum trend. The Queen sandstones are productive of dry gas in Eumont gas field, and Byers-Queen gas field. Langlie-Mattix and Caprock-Queen fields are both large producers of Queen oil. The Queen is at present being actively developed. It has produced over 9 per cent of the state's total oil production, but will greatly exceed that figure for 1955.

Seven Rivers . . . The Seven Rivers formation is composed of sandstone, dolomites, anhydrites, and red beds. Although the Seven Rivers formation has produced only 1 per cent of the state's total oil production, it is often very prolific in areas such as Wilson, and Cooper-Jal fields. The dry gas of the Seven Rivers formation is found in the Jalmat and Eumont gas fields.

Yates . . . The Yates is primarily a sandstone. It contains large reserves of dry gas in Jalmat and Eumont gas fields. Yates oil production is obtained in a relatively narrow band close behind the Capitan reef, but it also produces considerable oil from synclinal structures in the Jalmat gas pool. The Yates formation is the most widely used horizon for mapping in the Permian basin, due to being a diagnostic with numerous points available. The Yates is presently producing about 2 per cent of the state's daily allowable. But it has produced in excess of 3 per cent of the state's total production. Three wells in the Lynch pool have each produced over 2,000,000 bbl. of oil.

Tansill . . . The Tansill formation has favorable sediments for reservoir beds in a very narrow belt near the Capitan reef. As yet no oil production is obtained from the Tansill formation, but it is productive of dry gas in scattered areas of the Jalmat gas pool. Scanlon and Hale fields each have a dry gas well completed in the Tansill formation which have been shut in since completion.

Ochoa series . . . The Ochoa series is principally a section of thick halite and anhydrite section which reaches 4,000 ft. in thickness. The salt section is important for the commercial potash. The Castile, in a local development of dolomite, has produced 1,500 bbl. of oil from one well. This is the youngest producing horizon in southeastern New Mexico.

EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

A new oil pool east of Flint Ridge field has been found by Central Ohio Oil & Gas Co. on 1 Thomas Esselstein, in Lot 36, Hopewell Township, Muskingum County. Clinton sand was logged at 3,147-87 ft. and produced 200 bbl. and 125,000 cu. ft. gas in a 24-hour test after fracturing.

• Pure Oil Co.'s first offset to its Black Run pool extension in Jackson Township, Muskingum County, gaged 168 bbl. in 24 hours after fracturing. On 1 J. H. Frazier, Section 24, the Clinton was found at 3,000-56 ft. with the oil pay at 3,040-56 ft.

• At the east end of old Union Furnace field in Starr Township, Hocking County, the J. S. Bolin et al 1 A. L. Jones, Section 5, will probably influence additional drilling. Clinton at 3,233-66 ft. gaged 25 bbl. natural and 140 bbl. in 24-hour test after fracturing.

EASTERN KENTUCKY

In Breathitt County and located on Fugate Creek, Preston Oil Co. has completed 1419 Ervine Turner as an oil producer. Bottomed at 1,264 ft. the test had Maxon (Mississippian) oil sand at 1,249 to 1,262 ft. On completion tests well gaged at the rate of 30 bbl. oil daily natural. Test is the second in the area and offsets discovery well completed some months ago.

PENNSYLVANIA

In Gaskill Township, Jefferson County, Southwest Pennsylvania, Columbian Carbon Co., completed 1830 Harriett C. McClure, wildcat gaging 2,843,000 cu. ft., gas in the chert.

• Young Township, Indiana County, Manufacturers Light & Heat Co. 4336 Stewart and R. & P. Coal Co., is drilling at 633 ft.

WEST VIRGINIA

Licking district, Tucker County, West Virginia, Hope Natural Gas Co. 9966 T. A. Loughry, reached the Oriskany sand at 5,100 ft., with gas testing 112,000 cu. ft., at 5,103-05 ft., and is shut down at 5,180 ft., after encountering water.

• In St. George district, Columbian Carbon Co. 1219 U.S.A. topped the Oriskany sand at 4,374 ft., and shut down at 4,509 ft., to fracture.

MID-CONTINENT

OKLAHOMA

Completion Tests Reported At Grant County Discoveries

Calvert Drilling Co. 1 Dallem, SW SW SW 22-28n-6w, Grant County, flowed 13,500 M.c.f. of gas per day with 90 bbl. distillate per day from Pennsylvanian sand perforations at 4,762-90 ft. after fracturing. The 1 Davis, SE SE NE 28-28n-5w, flowed 7,500 M.c.f. of gas per day and 48 bbl. of distillate per day from perforations at 4,708-18 ft.

These two wells are the latest additions to a 30-mile basal Pennsylvanian

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sand oil and gas-distillate trend that is shaping up in Alfalfa and Grant counties, along the northern border of Oklahoma.

KANSAS

Potential Awaited at Kingman County Strike

Wilcox Oil & Gas Co. is waiting for potential at its 1 Gilchrist, new Kansas City discovery in SE NW NE 15-30s-7w, 1 mile southeast of Rago.

Acidization of perforations at 3,726-31 ft. in the Kansas City caused an oil flow of 316 bbl. in 16 hours before the well was shut in.

HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

Morrow Flow Reported At Texas County Wildcat

Morrow oil has been found at a geological wildcat inside Hugoton field in Texas County. Musgrove Petroleum Co. 2-4 Woodward, C SE NW 4-5n-12eCM, flowed 14 bbl. of 42.4°-gravity oil per hour through open tubing from perforations in the Morrow sand at 6,004-15 ft.

Dower Field Discovery Well Finaled in Morrow

Sunray Mid-Continent Oil Co. has completed its 1 Palmer in NE NE SW 28-1n-21eCM, opening Dower pool in Beaver County. The well had an open flow calculated at 15,500 M.c.f. of gas per day and 30 bbl. of distillate per million from perforations in the lower Morrow sand at 8,042-62 ft.

PACIFIC COAST

CALIFORNIA

Pump Test Middle Dome Deep Wildcat

Middle Dome Corp. has put 38-19V Well, a deep wildcat in the Middle Dome region of Kettleman Hills, Kings County, on pump for tests. The first such test of a fractured shale interval at 11,151-12,250 ft. produced at a 120 bbl. daily rate of 31°-33°-gravity crude and 6 bbl. of sand, not cut.

The operators originally took this wildcat to 13,076 ft. and then plugged back to 12,250 ft. The zone being tested is Eocene age. The well hit the top of the Miocene age Vaqueros sand at 1,096 ft.

Abandonment Hits New Sunset Beach Area

The first significant abandonment has occurred in the booming new pool area of Sunset Heights in the Sunset Beach field, Orange County. O. Biller 1 Graham Community, located less than ¼ mile east of the townlot drilling area, was abandoned at 8,312 ft. On a test of the bottom 200 ft. the operator recovered 1,400 ft. of salt water with no oil or gas shows.

Richfield Tests WSO On Boyle Heights Well

Richfield Oil Corp. was testing a water shut-off at 3,110 ft. in 1 Boyle Industrial. This wildcat, located in the industrial district of East Los Angeles, has been plugged back and redrilled five times. Present redrilled depth is 3,180 ft.

New Pool Hit in South Mountain Field

The Texas Co. was preparing to run casing in 1 Richardson-Earl, a new pool discovery ½ mile west of main production in South Mountain field of Ventura County. The pool in which this 7,720 ft. extension test is being com-

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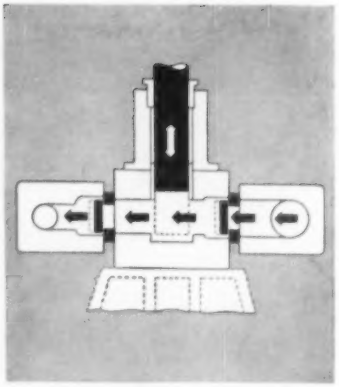

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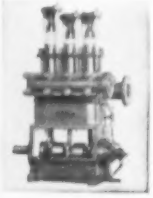

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pleted has been designated Bridge pool. The drill site is NE SW 14-3n-21w.

In other South Mountain activity, Humble Oil & Refining Co. was preparing two sites for south extension tests. Both are about 1 mile south of the main producing area.

GREAT LAKES

MICHIGAN

The Panhandle Eastern Pipe Line Co. 1 Teltow, NE NE NW 22-4n-15e, new A-1 dolomite, basal Salina, gas discovery well, Casco Township, St. Clair County, was rated good for 2,522,000 cu. ft. of gas a day after a 2,000-gal. acidization. Gas flow was boosted from 780,000 cu. ft. a day natural. Both flows were gaged. Top of A-1 dolomite was logged at 2,380 ft. Pay showed from 2,386-2,437 ft. Hole was drilled to 2,443 ft., total depth.

An interesting west-state wildcat, scheduled to drill Dundee-Reed City zone, logged Traverse horizon structurally higher than all correlating control points by some 29 ft., a small showing of oil in the very top of the Traverse, and a hole full of water 26 ft. in the Traverse objective. Wildcat, which will be closely watched as Dundee-Reed City zones are drilled, and which will stimulate additional exploratory drilling in the area, is Granville C. Berlin 1 Van Agtmael, SW SW NW 36-15n-16w, Elbridge Township, Oceana County. Top of Traverse was logged at 2,118 ft.

Klondike Petroleum Co., Inc., logged a shallow offset to Huber field discovery well, Newaygo County, but this offset will be carried to the Traverse pay objective. The 2 Hoge, NE SW SE 5-14n-14w, logged a stringer sand gas pay at 602-05 ft. which was gaged at 250,000 cu. ft. of gas a day.

Carter Oil Co. established one barrier on the northeast side of Huber pool as its 3 Allers, SW NE SW 4-14n-14w carried 1,260 ft. of salt water from the Traverse on a 60-minute drill-stem test run at 2,091-2,103 ft.

ROCKY MOUNTAIN

COLORADO

Committees Named for Geological Meeting

F. A. (Gus) Thurman of Denver recently announced committee assignments for what promises to be the largest meeting of Rocky Mountain geologists in history.

They will work with Thurman, president of the Rocky Mountain Section of the American Association of Petroleum Geologists, on the group's annual convention to be held in Denver city auditorium next February 27, 28 and 29.

Advance registrations indicate an attendance of more than 2,500. Among these will be many from other areas interested in learning more of exploration and production in the Rockies.

The discussion theme will center on earth movements which created the Rockies and the resulting accumulation of oil and gas. The geology of uranium also will be studied.

Thurman named Laurence Brundall of the Denver office of Geophoto Services, Inc., as general chairman. John Blixt, of Halbert, Jennings and Simic, and John Maxson, Denver consultant, will serve on the central convention committee with Brundall and Thurman.

Committee chairmen named by Thurman include:

Program—George Downs, consultant; Housing—Robert Landon, General Petroleum Corp.; Exhibits—Don Vieaux, Phillips Petroleum; Registration-Reception—Martin Deuth, Shell Oil; Technical Services—Scotty Knox of Knox Bergman and Shearer; Entertainment—Dave Evans, Sharples Oil; Publicity—Bill Goodin, Petroleum Information; Transportation—Gordon Hurd, consultant, and Ladies Coordinator—Bill Newton, consultant. All committee chairmen are from Denver.

WESTERN CANADA

Oil Flow Reported At Burbank Wildcat

The first well drilled on Crown Drilling Reservation No. 101 in the interesting Burbank area of west-central Alberta, by a team headed by Bailey-Selburn, gave a good flow of light-gravity crude oil during initial drill-stem test. It was reported that the well had a pay thickness of 24 ft. and an estimated flow rate of 1,200 bbl. daily. The well is located about 7 miles northeast of Red Deer City.

Information available indicates the well will be one of the best drilled in the area to date. Baysel-Crowsnest 2-14 Conick Burbank is located on LSD 2, 14-39-27w4. It is on a crown drilling reservation purchased by the group for a cash bonus of $1,464,618 at the November 24 sale. It is 1¾ miles southeast of the Imperial Oil, Ltd., 13-15 Burbank Viking oil discovery well and ⅝ mile southeast of the California Standard Co.'s 5-14 Burbank, successful extension to the Burbank light-gravity oil strike.

The Viking sand was topped at 5,126 ft. or sub-sea elevation of 2,264 ft. based on K.B. elevation of 2,862 ft. The well was cored through the interval of 5,125 ft. to 5,154 ft. and it was drilled to a total depth of 5,220 ft. Seven-inch casing was run to total depth.

Drill-stem test, was run of the interval 5,134 to 5,154 ft. with the valve open 40 minutes and shut in 15 minutes. Natural gas flowed to surface in 5 minutes at a decreasing rate too small to measure. Crude oil flowed to surface in 30 minutes.

SASKATCHEWAN

Mission Canyon Discovery Reported at Glen Ewen

Rio-Palmer Oils, Ltd., has discovered oil in the Mission Canyon zone of the Mississippian at a wildcat well in the Glen Ewen area of southeastern Saskatchewan. This well is 12 miles southwest of the Rosebank oilfield, and 13 miles southwest of Alida oil field which brings it about 45 miles east-northeast of Estevan.

During the initial drill-stem test in the discovery zone. This well, Rio-Palmer 16-22 Crystal Wood, located on LSD 16, 22-2-34w1, flowed oil to surface at a rate estimated between 50 and 100 bbl. per hour. The full thickness of the pay zone has not been indicated because Rio-Palmer will run production casing and complete the well at the present total depth of 21 ft. into the Mission Canyon.

The Mission Canyon was topped at 4,061 ft. and a drill-stem test was run at the interval of 4,060-82 ft. Gas flowed to surface immediately and after 3 minutes was measured at 500,000 cu. ft. daily.

SOUTHWEST TEXAS

Second Well Confirms Production at Oblate

Shell Oil Co.'s recent discovery of gas-condensate production in the Oblate area, 10 miles north of Mission, in Hidalgo County, has been confirmed by Superior Oil Co. at its 1 Shary, 2,210 ft. southeast of the Shell discovery.

Superior's well, good for 6,000,000 cu. ft. of gas per day on open-flow potential rating, is perforated in the discovery well's deeper pay at 7,576-82 ft. The discovery well, completed last September for 82,000,000 cu. ft. of gas per day, open-flow from that sand, is perforated at 7,562-82 ft. It also is productive from a shallower pay, perforated at 7,390-7,408 ft.

Superior's well also is a potential producer from a 7,200-ft. sand, in

which a drill-stem test flowed gas and recovered 57.3°-gravity condensate. Condensate yield from the deeper sand is in the ratio of 1 bbl. to 161,300 cu. ft. of gas. Gravity is 54.7°.

Ben Bolt Wildcat Opens New Oil Producing Area

Fletcher Oil & Gas Drilling Corp.'s new oil-discovery well 3 miles northwest of Ben Bolt, in Jim Wells County, flowed at the rate of 103 bbl. of 43°-gravity oil per day on final completion test.

Flow was through ¼-in. choke with pressure of 150 psi. and gas-oil ratio of 152 cu. ft. per barrel. Pay is perforated at 5,324-28 ft. and 5,332-38 ft.

The discovery is designated as "North Ben Bolt," being about 1½ miles north of Ben Bolt field. It is about the same distance south of Tom Graham field, and east of the south end of South Alice field.

Chalk Discovery Completed

A new basal Austin chalk-Eagleford producing area has been opened in Caldwell County. Discovery well, Carnes W. Weaver and Brazos Oil & Gas Co. 1 Bandy, produced 88.58 bbl. of 36.7°-gravity oil (net) per day at completion with pay perforated at 2,048-66 ft. and 2,081-2,122 ft. It is about ½ mile northwest of chalk production in O'Leary field.

GULF COAST

TEXAS GULF COAST

Dual-Zone Well Opens New Splendora Production

Slick Oil Co., Ltd., has a new dual-zone gas-condensate discovery well 1½ miles northwest of Splendora, in southeastern Montgomery County. Its 1 Kate Glass et al, in the William Barker Survey, produced at the rate of 5,000,000 cu. ft. of gas per day with 6 bbl. of 59°-gravity condensate per 1,000,000 cu. ft. from perforations at 7,070-85 ft.

From its lower pay, perforated at 7,202-06 ft., production was rated at 9,200,000 cu. ft. of gas per day with 17 bbl. of 56°-gravity condensate per 1,000,000 cu. ft. Shut-in pressures are 2,369 psi. in the upper zone, and 2,604 ft. in the lower zone.

Deeper Pay Produces on Barbers Hill North Side

Deeper discovery by The Texas Co. of Yegua production in a deep wildcat on the north flank of the old Barbers Hill dome, in Chambers County, has been confirmed in the company's second well.

The second well, 2 Kirby, 956 ft. northwest of the discovery well, completed last September, opens a deeper zone, 300 ft. below the discovery well's pay, perforated at 10,743-10,822 ft. The new pay is perforated at 11,127-50 ft. Its open-flow potential is rated at 5,800,000 cu. ft. of gas per day, yielding 27 bbl. of 48.8°-gravity condensate per 1,000,000 cu. ft.

The discovery well was rated good for 62,500,000 cu. ft. of gas per day with a gas-condensate ratio of 44,100 cu. ft. per barrel.

Successful Wildcats

ALBERTA

Canadian Exploration Syndicate 8-20, LSD 8, 20-34-7w4. TD 2,803 ft. Gas well.

BRITISH COLUMBIA

Imperial-C Ivan 4-27 Boig River, LSD 4, 27-88-17w6. TD 5,675 ft. Nikinassin gas well.

SOUTH LOUISIANA

Beauregard Parish: Harry W. Bass 1 Sabine, 14-3s-12w. IP 394 BOPD, 7/32-in., 39°, perforations 7,909-16 ft. (upper Wilcox). TD 8,475 ft. (New field.)

Cameron Parish: Kerr-McGee Oil Industries, Inc., 1 Kerr-McGee and Monterey Miami Corp., 32-14s-14w. IP 150 BCPD and 5,000 M.c.f. daily, ⅞-in., 51.8°, perforations 12,405-20 ft. TD 13,000 ft. (New field in Grand Chenier area.)

Jefferson Parish: CATC Group (operated by Continental Oil Co.) 1-A State Lease 953, Block 47, Grand Isle Area, Gulf of Mexico. IP 410 BOPD, 5/32-in., 37°, perforations 13,614-20 ft., and (dual completion) 348 BOPD, 5/32-in., 33°, perforations 9,868-74 ft. TD 15,058 ft. (New offshore field.)

Terrebonne Parish: Robert W. O'Meara 1 LL&E, 4-24s-20e. IP 239 BOPD, 7/64-in., 32.6°, perforations 10,758-64 ft. TD 11,039 ft. (New field in South Caillou Island area.)

Vermilion Parish: Drilling & Exploration, Inc., and Harry Hurt 1 Trahan, 18-13s-1e. IP 70,000 M.c.f. daily, open-flow potential, 15.14 BC per M.M.c.f., perforations 11,152-67 ft. TD 11,188 ft. (New field.)

MICHIGAN

St. Clair County: Panhandle Eastern Pipe Line Co. 1 Teltow, NE NE NW 22-4n-15e. IP 2,522 M.c.f. daily, A-1 Basal Salina dolomite 2,380 ft., pay 2,386-2,437 ft. TD 2,443 ft. (New pool.)

OHIO

Muskingum County: Central Ohio Oil & Gas Co. 1 Thomas Esselstein, Lot 36, Hopewell Township. IP 200 BOPD, Clinton 3,147-87 ft. TD 3,212 ft. New pool.

PENNSYLVANIA

Jefferson County, Gaskill Township: Columbian Carbon Co. 1830 Harriett C. McClure, 2,843,000 cu. ft. gas in the chert, Onondaga Lime 7,938-85 ft., chert 7,985-8,110 ft. TD 8,110 ft.

WEST CENTRAL TEXAS

Coleman County: Haynes B. Ownby Drilling Co. 1 McCord, J. H. Gibson Sur. 15, 7½ mi. NE Talpa. IP 132 BOPD, 11/64-in., TP 600 psi., 41°, GOR 1750, Gardner sand 3,602-06 ft. TD 3,750 ft.

Eastland County: J. H. Elder 1 Tipton, Sec. 471, ETRR Sur., 8 mi. N Cisco. IPP 93 BOPD, 52°, GOR zero, pay 4,070 ft. TD 4,100 ft.

Nolan County: Rhodes Drilling Co. 1 Hale, 49-20-T&P, 5 mi. SW Trent. IPP 64 BOPD, 38°, GOR 100, Noodle Creek lime 2,935 ft. TD 3,000 ft.

Skelly Oil Co. 1-E Boyd, 60-X-T&P, 5 mi. NW Nolan. IP 466 BO in 8 hr., 18/64-in., TP 250 psi., GOR 1080, 44°, pay 5,653 ft. TD 6,690 ft. Strawn discovery in EVB-Ellenburger field.

Stonewall County: Fletcher Oil & Gas Corp. 1 Carothers, Sec. 13, A41-BBB&C Sur., 4 mi. NE Old Glory. IPP 154 BOPD, 41°, conglomerate 5,923-52 ft. TD 5,990 ft.

TEXAS GULF COAST

Jefferson County: W. B. Jayred 5 Fitzhugh, Lot 3, S. Eaton Sur. IP 103.2 BOPD, ⅛-in., 22.1°, perforations 6,232-51 ft. (Miocene). TD 6,537 ft. (New pay in Big Hill field.)

Liberty County: Lenoir M. Josey, Inc., 1 Chambliss, Lot 3, Liberty Town Tract, A-359. IP 34,000 M.c.f. daily, open-flow potential, GLR 16 M.c.f. per bbl. 60.2°, perforations 9,956-60 ft. (Cook Mountain). TD 10,021 ft. (New pay in South Liberty field.)

Nueces County: Wymore Oil Co. 1 Rockett, Partition of Wright Lands, Share 2. IP 144 BOPD, P-39 choke, 43°, perforations 7,751-61 ft., and (dual completion) 70 BOPD, P-35 choke, 43°, perforations 5,909-19 ft. TD 7,450 ft. (New field.)

Orange County: Sinclair Oil & Gas Co. 1 Martin Palmer Fee, Martin Palmer Sur., A-19. IP 184.10 BOPD, 9/64-in., 37.1°, perforations 7,266-71 ft. TD 7,428 ft. (New pay in Orange field.)

Wharton County: Anderson & Cooke and L. Martin 1 Putnam, WCRR Sur. 43, A-365. IP 89.59 BOPD, 7/64-in., 24°, perforations 4,117-22 ft. TD 5,218 ft. (New pay in North Louise field.)

SOUTHWEST TEXAS

Hidalgo County: Sun Oil Co. 1 Yturria-Delhi, Porcion 44. IP 12,000 M.c.f. daily, open-flow potential, dry gas, perforations 4,144-50 ft. TD 6,016 ft. (New field—proposed name "South Daskam.")

WEST TEXAS

Andrews County: Walter J. Dueease 1 Superior-University, 25-11-University Sur., 17 miles SW Andrews. IP 451 BOPD, 12/64-in., TP 220 psi., GOR 1129, 41°, Clear Fork 5,606-46 ft. TD 5,940 ft.

Phillips Petroleum Co. 66 University Andrews, 12-11-University Lands, 13 miles NW Goldsmith. IP 108 BOPD, 12/64-in., TP 210 psi., GOR 503, 42°, Tubb pay 6,260 ft. TD 9,275 ft., PB 6,394 ft.

Glasscock County: Southland Royalty Co. 1 McDowell, 35-34-T2S-T&P, 11 miles NW Garden City. IPP 63 BOPD, 31°, GOR zero, San Andres pay 2,485 ft. TD 3,040 ft.

NORTH TEXAS

Clay County: L. T. Burns 1 Denson, A. Smith Sur., A-415, 2 miles NW Shannon. IPP 88 BOPD, 41°, GOR 167, Strawn 3,334-39 ft. TD 6,162 ft.

Grayson County: An-Son Petroleum Corp. 1 Wood, R. E. Butridge Sur., A-190, 2 miles S Sadler. IPP 171 BOPD, 24°, GOR 30, pay 6,113-26 ft. TD 6,198 ft.

Hancock takes post as a . . .

. . . President with a Program

A TRANSPLANTED Kansan who literally grew up with the company that bears his name today guides the West's largest industry organization.

John W. Hancock, president of Hancock Oil Co., Long Beach, has dedicated himself to the same oil men's axioms in running Western Oil and Gas Association that marked his own growth.

Hancock sees his new duties as a challenge: To free the oil industry of federal controls and keep it free.

The fortyish Californian has pledged himself to continue striving for "the principles of free enterprise which have permitted the industry to offer high-quality services and products to the benefit of the consumer."

Hancock, son of one of the company's founders, was born in Erie, Kans. But his education — academic and oil—came on the West Coast. He attended high school and college in Long Beach. In 1924 he began working summer vacations from high school in Hancock's Signal Hill refinery.

He switched his vacation efforts from refining to land and lease departments in 1928, continuing to expand his knowledge of the firm as he attended classes at Long Beach City College and Southwestern University there in 1932 and 1933.

As Hancock progressed into executive capacities, he worked in almost every department. He became, successively, assistant to the president, assistant vice president, and chairman of the company's management committee.

In 1947 he was named executive vice president, and in February 1953 he became the firm's second president.

Today Hancock's company has seven branch offices keeping tab on about 100,000 bbl. daily of production in California and Wyoming. The firm also holds undeveloped acreage in nine other Mid-Continent and Rocky Mountain states.

Through an interest in American Independent Oil Co., Hancock owns production in the Kuwait-Saudi Arabia Neutral Zone.

The company also holds substantial interests in four domestic firms, including 89 per cent of Hancock Chemical Co.

Hancock lives in Long Beach with his wife and four children (8 to 18). He hopes his new post at the helm of Western Oil and Gas doesn't curtail several hobbies. Heretofore, he has found time for hunting, operating ham radios, and flying. He holds a pilot's license.

But his clear statement of the problems facing producers, refiners, and distributors in the Western states indicates he'll be a busy man during the coming year.

What are these problems? Hancock sees them this way:

. . . **Selling the public** on industry efforts to reduce smog polution.

. . . **Removing direct federal controls** on natural-gas production.

. . . **Fair and orderly development** of California's offshore reserves.

. . . **Keeping the depletion allowance** intact—to encourage development of risk-taking and thus insure adequate reserves.

Transforming these problems to achievements will be Hancock's job with the association. Helping him will be this new slate of officers: S. F. Bowlby, Shell Oil Co., first vice president; Olen Lane, Continental Oil Co., second vice president; T. H. Wallace, Western Gulf Oil Co., treasurer; and Felix Chappellet, association vice president and general manager.

Elected new directors were H. D. Campbell, Franco Western Oil Co.; E. B. Hall, Drilling & Production Co.; James T. Wood, Jr., The Texas Co.; and John A. Woodward, St. Anthony Oil Co.

Hancock succeeded Charles S. Jones, president of Richfield Oil Corp., who had served as president 2 years.

H. C. McCarver has been promoted by Seaboard Oil Co. to assistant vice president and assistant general manager of the Mid-Continent division, Dallas. He formerly managed the firm's geological and geophysical departments there.

W. S. Lytle, president of Pennsylvania's Middle District Crude Association, has been named a director of the Pennsylvania Grade Crude Oil Association. Other new directors: **E. W. Beedle, Jr.,** president of Southwest Pennsylvania Producers Association; **E. B. Curry,** president, West Virginia Oil and Natural Gas Men's Association; and **W. E. Shrider,** head of Ohio Oil and Gas Association.

William W. Walmsley, agent for Sun Oil Co.'s Rocky Mountain division headquarters at Denver, has been moved up to assistant division manager there. Walmsley joined Sun in 1951 as a district landman.

Richard B. Banks has resigned as geophysicist with Carter Oil Co. at Shreveport to join Jack Gryhberg & Associates at Denver.

Doyle McClennen has resigned as petroleum engineer with Stanolind Oil & Gas Co. in Fort Worth to join Plymouth Oil Co. as regional petroleum engineer for West Texas and New Mexico. McClennen, a 1951 graduate of Texas Technological College, will be located at Midland, Tex.

Byron E. Milner, head of Altantic Refining Co.'s licensing section since 1953, has been made technical assistant to the firm's vice president and general manager of manufacturing. **John A. Nevison,** former assistant licensing head, succeeds Miller.

William C. Hickey has resigned as engineer in Amerada Petroleum Corp.'s production department, Tulsa, to join Standard-Vacuum Oil Co. as a petroleum engineer in Sumatra.

Howard A. Gibson, former Denver consulting geologist, has joined Republic Natural Gas Co. as Rocky Mountain division manager. Gibson soon will open Denver offices for the firm, which is active with the Chicago Corp. in Rockies exploration.

PERSONALS

These Men Will Direct Permian Basin Society

Decker Dawson, center, head of Dawson Geophysical Co., has been elected president of the Permian Basin Geophysical Society for 1956. Other new officers are, left to right: R. Maxey Pinson, Union Oil Co. of California, first vice president; W. A. Seal, Jr., Continental Geophysical Co., second vice president; Malcolm A. Knock, Stanolind Oil & Gas Co., secretary; and R. J. Knott, Atlantic Refining Co., treasurer.

Bishop Craddock, production superintendent for Honolulu Oil Corp. at Sundown, Tex., has been elected chairman of the South Plains chapter of the American Petroleum Institute. Others elected: **Murry McNichol,** Service Pipe Line Co., Lubbock, Tex., first vice chairman; and **L. L. Cox,** Cities Service Oil Co., Levelland, Tex., second vice chairman.

Arthur Thad Smith, Continental Oil Co., has been named to head the Rocky Mountain Mineral Law Foundation's board of trustees. Other new officers: **William J. Wehrli,** Rocky Mountain Oil and Gas Association, vice president; **Clyde O. Martz,** of the University of Colorado faculty, executive secretary; and **Howard Gullickson,** Shell Oil Co., treasurer.

Wayne Z. Burkhead, vice president of T.X.L. Oil Corp., Dallas, has been named a director. Burkhead joined T.X.L. last March as chief geologist. He had held a like post with Union Oil Co. of California's Gulf division.

P. L. Smith and **Ray C. Adams** have been promoted to executive assistants in Magnolia Petroleum Co.'s Beaumont refinery. The posts were set up recently to aid in supervising operating, engineering, technical, and budget work at the plant. Smith has directed the refinery's technical department for 17 years. Adams has been chief process engineer in that department.

Joe C. Hardin, a director of Arkansas Louisiana Gas Co., has been named vice president and general manager of the firm's Arkansas operations. He succeeds **Robert W. Curran,** veteran of 45 years with the firm and predecessors. Curran will remain until August 15 as a consultant.

Forrest W. Lewis, Jr., has been made manager of Texas Gas Transportation Corp.'s new gas-storage department. Lewis, who has been senior research and development engineer, will remain in T.G.T.'s Owensboro, Ky., offices.

Herb Miller, of Amerada Oil Corp., Longview, Tex., has been named 1956 chairman of the East Texas section, American Institute of Mining & Metallurgical Engineers. **J. A. Butts, Jr.,** was elected vice chairman, and **J. E. Pierce** is new secretary-treasurer. Both are with Tide Water Associated Oil Co. at Kilgore, Tex.

Henry G. Abadie, Long Beach Oil Development Co., has been elected chairman of the Los Angeles Basin chapter of the American Petroleum Institute. Other new officers: **Don S. Hare,** Monterey Oil Co., vice chairman and program chairman; and **William (Andy) Anderson,** Oil Tool Corp., secretary-treasurer.

Charles Scrymgeour, superintendent of Imperial Oil, Ltd.'s, Montreal East refinery since 1952, has been transferred to the Toronto headquarters as management development counselor. Other changes, affecting six of Imperial's nine refineries: **Dr. J. L. Huggett,** general superintendent of the Sarnia works, succeeds Scrymgeour; **George R. McMillin,** superintendent at Halifax, replaces Huggett at Sarnia; **H. H. Moor,** head of the plant at Edmonton, moves to Halifax; **E. Keith Lewis,** now at Ioco, succeeds Moor; **A. G. Lewis** goes from Winnipeg to Ioco; **W. A. Murray,** superintendent at, at the Sarnia works, becomes manager at Winnipeg; and **W. J. Beynon,** assistant superintendent at Sarnia, takes over Murray's job and the title of assistant manager.

Orin Atkins, member of the legal staff of Ashland Oil & Refining Co. since 1950, has been named executive assistant to the management.

Robert L. Layden, Sun Oil Co., San Antonio, has been elected president of the Gulf Coast Geological Society for 1956. Other new officers: **Michael W. Beckman,** Shreveport independent, vice president; **Charles W. Halcomb,** Humble Oil & Refining Co., Corpus Christi, secretary; and **Alvin S. Scott,** Jergins of Texas, Ltd., San Antonio, treasurer.

William A. Burns has been moved up from supervisor to manager of American Oil Co.'s Savannah, Ga., refinery. Burns succeeds **Edward R. Grey,** who will replace **William W. Hulin** as manager of American's Baltimore refinery. Hulin retires February 1. Burns joined American in 1943. He served as chemical engineer and general foreman at the firm's Texas City, Tex., plant before coming to Savannah in 1952. Grey joined the company in 1933. He was named chief engineer at Savannah in 1941 and served as assistant superintendent there from 1945 until 1948.

Ardie V. Hill, veteran employe of Drilling & Exploration Co., Inc., has been made manager of the firm's Iranian operations, with headquarters at Teheran. Hill has been superintendent of Netherlands Drilling Co., European subsidiary of Drilling & Exploration. Earlier, he supervised West Texas drilling operations.

John C. Woelfel, retired Navy captain, has been named to manage Richfield Oil Corp.'s tanker operations.

PERSONALS

Robert K. Summy has resigned as land manager for Hancock Oil Co. to manage oil and gas exploration for the Sesnon and Cartan interests, San Francisco and Los Angeles.

Lucien O. Crockett, general manager of Gulf Oil Corp.'s chemical department, has been elected a vice president. Crockett joined Gulf in 1922 as a laboratory assistant. In 1934 he was named chief chemist for Gulf's Texas refineries, and in 1945 became assistant general superintendent of refining there. Later he served as manager of the firm's petrochemical activities unit in Pittsburgh. Crockett also is a director and executive committee member of Goodrich Chemicals, Inc., jointly owned by Gulf and B. F. Goodrich Co.

William F. Bates, Coastal division production manager for Shell Oil Co. in Ventura, Calif., has been promoted to assistant to the vice president in Los Angeles. Bates is succeeded by **Arthur L. Brown,** who has been production manager for Shell's Salt Lake City division.

Ronald J. Cullen, assistant chief geologist in Sun Oil Co.'s Mid-Continent division, has been promoted to chief geologist. Cullen succeeds **Samuel H. Woods,** who has retired after 34 years with Sun.

Dr. Gordon Rittenhouse, former coordinator of special geological studies for Shell Oil Co. at Denver, has been named to manage Shell Development Co.'s exploration and production research division in Houston. Rittenhouse takes over the post in the absence of **Rufus J. Le Blanc,** who will conduct a geological study of the Gulf of Mexico for Shell's exploration technical services. **Sherwood Buckstaff,** former exploration manager in the Houston area, will assist Le Blanc.

W. L. Boosa, Cities Service Oil Co., Pampa, Tex., has been elected president of the American Petroleum Institute's Panhandle chapter for 1956. Other new officers are **T. G. Hollingsworth, Jr.,** Shell Oil Corp., Borger, first vice chairman; **J. G. Glenny,** The Texas Co., Pampa, second vice chairman; and **Martin Ludeman,** West Pampa Repressuring Project, secretary-treasurer.

L. O. Ward has been transferred by Warren - Bradshaw Exploration Co. from the Northern Oklahoma-Southern Kansas district to the Southern Oklahoma-Northern Texas district as superintendent. Ward is succeeded by **C. Loyd Wagner,** promoted from tool pusher at Sweetwater, Tex.

MORRIS

Lee Morris, John H. Henderson, and **Jesse L. Boyce, Jr.,** have been named as key personnel in future operation of American Gilsonite Co.'s processing plant now being built near Grand Junction, Colo. Morris will be manager of operations. An employe of Standard Oil Co. of California since 1941, he recently was assistant manager of Standard of British Columbia's Vancouver refinery. Henderson, to be chief operations engineer, is a former Socal pipeline and refinery construction specialist. Boyce, named to manage the refinery, also is a former Socal employe. His field was operation and design engineering.

Bill A. Richards has resigned as geologist for Jones, Shelburne & Farmer to become an independent at Wichita.

M. M. Fidlar, exploration vice president of Mountain Fuel Supply Co. since 1953, has been elected a director. He replaces **C. R. Hetzler,** who has resigned after 20 years with M.F.S., the last 10 as director. Fidlar joined the firm in 1943 as senior geologist. He became chief geologist in 1945 and exploration manager in 1951. Hetzler retired in 1945 as the company's vice president for production and pipelines.

James C. Atkinson has resigned as geologist with Plymouth Oil Co. to become a consultant in Midland, Tex. He will specialize in photology.

Ralph Troseth, assistant general manager of Texas-New Mexico Pipe Line Co., Midland, Tex., has begun a 1-year leave of absence for an assignment with the State Department in Paris. **F. B. Whitaker, Jr.,** division manager at Midland, will replace Troseth during his absence.

Kye Trout, Jr., consulting geologist, has moved his main offices from Dallas to Beach, N. D., where he will concentrate on Williston Basin development.

Paul E. Sanders, assistant manager of General Petroleum Corp.'s Torrance, Calif., refinery, has retired after 36 years' service.

DEATHS

Mead S. Johnston, retired geological engineer and brother of Alexander Johnston, board chairman of Sinclair Crude Oil Co., died December 23 in Muskogee, Okla. Johnston was active most of his life as a Mid-Continent consultant, operating out of Tulsa from 1928 to 1941. Another brother, the late Gen. Hugh S. Johnston, directed the National Recovery Administration during depression days.

Charles A. Dore, 67, retired vice president of Superior Oil Co., died recently in Los Angeles. He had retired in 1939 after 25 years with Superior.

Claude A. Weber, 56, assistant vice president of Frontier Refining Co., Denver, died recently in North Platte, Neb.

Robert Gold, core analysis engineer with Hycalog, Inc., at Mount Pleasant, Mich., was killed December 23 in an automobile crash.

John C. Ratliffe, 50, Midland, Tex., independent, died there December 21. Active in the industry since the early 1920's, Ratliffe came to Midland in 1928 with Atlantic Pipe Line Co. In 1935 he formed Commanche Pipe Line Co., operating in Pecos County. He sold the line in 1945.

Wayne Colver, 76, petroleum engineer for Wilshire Oil Co., died December 20 in Los Angeles.

Harold C. Miller, director of the California-Nevada region of the U. S. Bureau of Mines, died recently in Las Vegas. Miller joined the bureau in 1932 as a petroleum engineer. In 1943 he received the Interior Department's distinguished service award, its highest honor, for his contributions to oil technology and conservation. He had been a regional director since 1949.

Joseph J. Maucini, district geologist for Superior Oil Co. at Wichita Falls, died there recently.

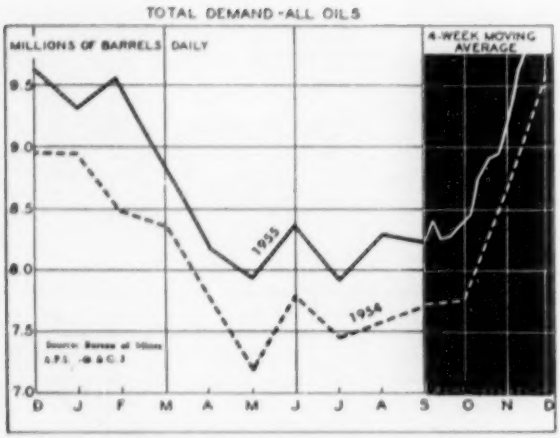
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,968,700	UP	21,650	UP	553,603
Crude stocks	258,059,000	UP	1,139,000	DOWN	7,434,000
Completions	973	DOWN	276	DOWN	129
Refinery runs*	7,684,000	UP	66,000	UP	458,000
Gasoline stocks*	160,406,000	UP	2,032,000	UP	8,628,000
Distillate stocks*	126,040,000	DOWN	8,373,000	UP	7,958,000
Residual stocks*	40,935,000	DOWN	1,832,000	DOWN	11,330,000
Four-product stocks*	357,290,000	DOWN	10,269,000	UP	3,229,000
Total imports*	1,292,700	DOWN	174,700	DOWN	60,200

*For week ended December 16.

ALL TABLES AND CHARTS, BASED ON A.P.I. REPORT, ARE FOR WEEK ENDED DECEMBER 16 SINCE THE A.P.I. REPORT FOR DECEMBER 23 WAS DELAYED BECAUSE OF CHRISTMAS HOLIDAYS



Expanded Market Coverage Starts This Week on Page 162

STARTING with this issue, the Journal is expanding its coverage of crude and product markets. Unless otherwise designated, these prices will be refinery and bulk-terminal quotations.

Group 3 prices are for northern movement. Cargo quotations are shown for the Gulf Coast and Caribbean areas. Most of the New York Harbor prices are for barge delivery. Refinery rack prices are shown for Los Angeles.

Gasoline price quotations are for the grades indicated by the octane numbers listed. Some areas have several grades of both premium and regular gasolines with prices varying according to octane ratings.

Natural-gasoline quotations are shown only for Grade 26-70. Prices for the lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. The price for Grade 18-55 will normally be 120 per cent of the Grade 26-70 price. Prices for grades below 16-lb. may vary slightly by areas or plants.

The Group 3 quotation for residual is for fuel with a maximum of 1.0 per cent sulfur. Prices listed for other areas cover Bunker C which normally does not carry any sulfur guarantee.

Gravity schedules are shown for five typical crudes, followed by a listing of flat crude prices for fields and areas in Louisiana, Texas, Pennsylvania, West Virginia, Ohio, and the Illinois basin. Postings also are shown for important fields in western Canada. Other foreign postings are listed for Venezuela, Middle East, and Far East.

Tanker rates for important voyages have been added to show the effects of changing transportation costs on delivered prices both in this country and abroad.

Any changes in quotations or postings will be shown by printing the current quotation in boldface type.

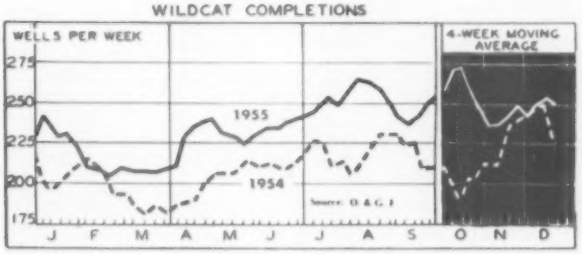
Group 3 distillate prices rise . . . Burning oils on the Group 3 market moved up another 0.125 cent a gallon just before Christmas. This raise brings No. 2 fuel to 8.75 cents a gallon for the low of the market. There have been some reports of spot sales over the new low.

Last year, No. 2 fuel was selling at exactly this same price on the Group 3 market, but did move up another 0.125 cent in the first week of January. Some Mid-Continent suppliers believe that further gains this season will depend on the weather in the early part of the new year.

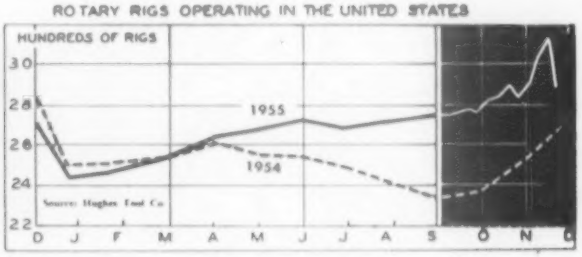
Warmer weather in the North Central states has given secondary suppliers a chance to catch up on consumer deliveries and to rebuild secondary stocks of heating oils.

Residual-fuel markets continue very strong in all areas. Some industrial plants in Missouri and Kansas are reported to be back on natural gas for a few days. However, these customers are still in the residual market, looking for material to replace the fuel consumed during the last cold wave.

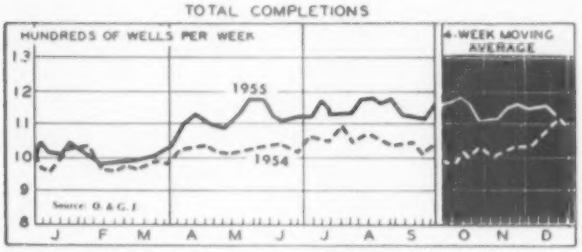
WILDCAT COMPLETIONS



ROTARY RIGS OPERATING IN THE UNITED STATES



TOTAL COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	12-26-55	Change from 12-19-55	Change from 12-27-54
Gulf Coast	678	—22	76
N. and W. Texas-New Mexico	1,004	—74	192
Arkansas-N. Louisiana-E. Texas	186	—10	—11
Oklahoma	307	—55	—1
Kansas-S. Nebraska	178	—29	1
Illinois-Eastern	130	—25	—9
Rocky Mountain	258	—33	9
Pacific Coast	143	— 5	—7
Total United States	2,884	—253	250
Western Canada	200	—1	4

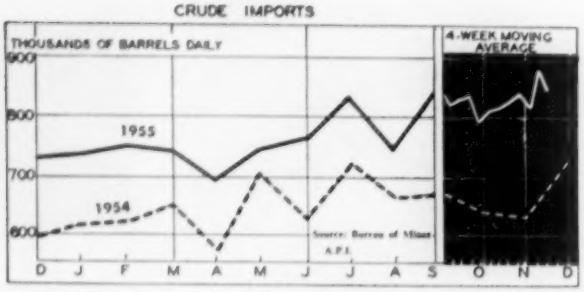
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 24, 1955

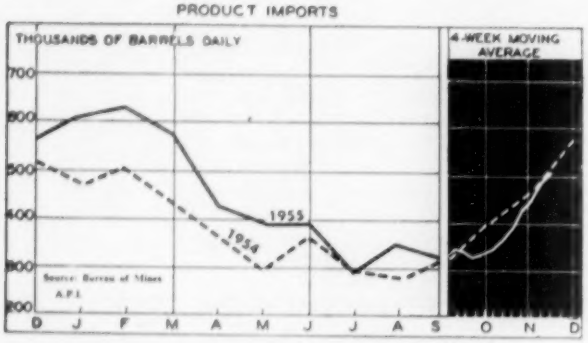
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	1	0	0	1	3,910	72	97	0	0	0	1	1	1	0	0	68	69
Arkansas	12	8	0	4	45,932	804	595	1	0	0	3	4	35	1	4	170	210
California	44	37	0	7	323,413	2,388	2,327	0	0	0	6	6	41	0	12	448	501
Colorado	25	2	0	23	137,250	1,479	1,339	1	0	0	14	15	50	0	24	718	792
Illinois	50	22	1	27	114,116	3,842	2,971	2	0	0	8	10	73	0	6	547	626
Indiana	7	3	0	4	11,400	699	879	0	0	0	1	1	11	0	0	249	260
Kansas	54	24	4	26	192,269	4,903	4,511	1	0	0	12	13	133	1	34	837	1,005
Kentucky	22	10	1	11	27,704	1,588	1,174	0	0	1	3	4	53	0	12	330	395
Louisiana	86	54	6	26	478,074	3,994	3,485	4	2	0	7	13	115	82	29	463	689
North	52	33	3	16	141,085	2,071	1,913	0	0	0	6	6	26	11	5	200	242
South	34	21	3	10	336,989	1,923	1,572	4	2	0	1	7	89	71	24	263	447
Michigan	4	1	1	2	12,031	507	556	0	0	1	2	3	12	0	2	195	209
Mississippi	9	4	0	5	62,664	448	424	0	0	0	5	5	14	0	0	168	182
Montana	11	7	1	3	54,538	399	330	0	0	0	2	2	13	0	2	149	164
Nebraska	14	7	0	7	82,009	884	439	1	0	0	3	4	45	0	1	372	418
New Mexico	34	11	19	4	135,138	1,684	1,093	0	0	0	0	0	40	2	10	120	172
Northwest	19	0	19	0	54,517	608	391	0	0	0	0	0	8	1	10	43	62
Southeast	15	11	0	4	80,621	1,076	702	0	0	0	0	0	32	1	0	77	110
North Dakota	4	4	0	0	42,743	251	303	0	0	0	0	0	7	0	0	61	68
Ohio	27	15	5	7	69,128	1,203	1,134	1	0	0	0	1	4	0	8	16	28
Oklahoma	78	45	7	*26	271,754	8,333	8,583	1	0	2	4	7	134	19	29	642	824
Pennsylvania-New York	20	2	14	4	59,207	1,444	2,145	0	0	1	0	1	0	0	9	11	20
Texas	429	248	13	168	1,881,657	19,968	18,180	16	1	3	98	118	776	110	132	4,102	5,120
Southwest (1 & 4)	69	32	4	33	224,019	3,083	2,527	3	0	2	22	27	118	36	40	783	977
Gulf Coast (2 & 3)	61	32	4	25	419,519	2,505	2,547	3	1	0	10	14	94	61	43	663	861
East (5 & 6)	21	7	3	11	90,267	983	1,005	0	0	1	7	8	24	5	11	325	365
North Central (7-B & 9)	158	90	1	67	519,070	7,448	6,922	7	0	0	35	42	368	0	17	1,629	2,014
West (7-C & 8)	109	85	0	24	581,453	4,910	4,245	3	0	0	23	26	162	1	12	664	839
Panhandle (10)	11	2	1	8	47,329	1,039	934	0	0	0	1	1	10	7	9	38	64
Utah	0	0	0	0	0	82	96	0	0	0	0	0	6	0	6	52	64
West Virginia	21	1	18	2	52,625	635	610	0	0	0	0	0	0	0	12	20	32
Wyoming	21	9	0	12	133,676	881	1,187	1	0	0	8	9	26	0	8	219	253
Miscellaneous	0	0	0	0	0	59	118	0	0	0	0	0	4	0	3	48	55
Total United States	**973**	514	90	369	4,191,238	56,547	52,576	29	3	8	177	**217**	1,593	215	343	10,005	12,156
Total previous week	1,249	660	91	498	4,911,246			34	1	11	229	275	1,564	212	335	9,828	11,939
Total Dec. 25, 1954	1,102	595	67	440	4,242,560			23	2	4	191	220	1,460	133	401	8,983	10,977
Western Canada	41	23	4	14	207,994												

Service wells included: *9, 12.

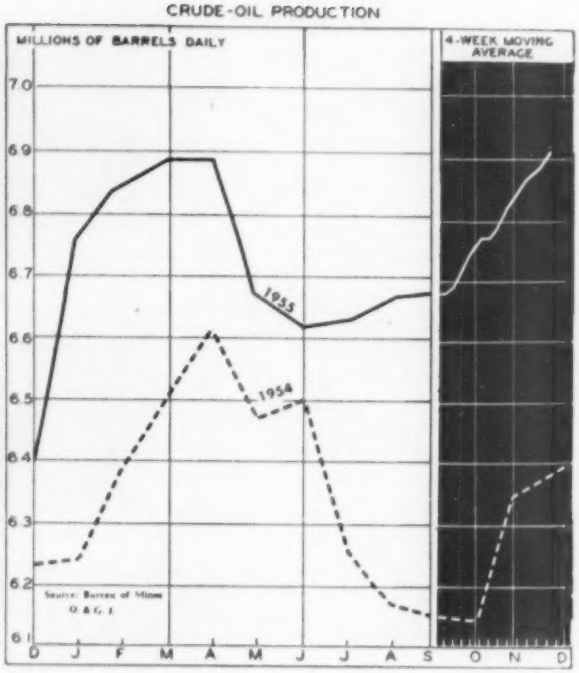
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

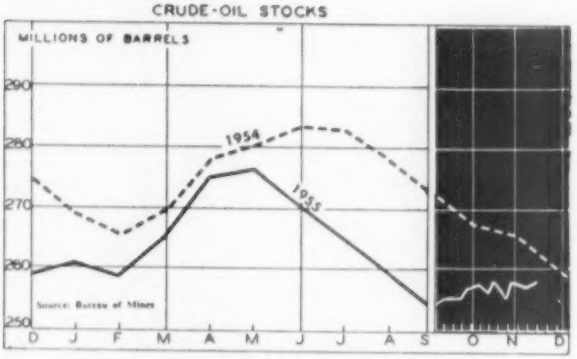


DAILY AVERAGE PRODUCTION FOR WEEK

	December 24 Crude oil	Lease condensate	Total	Dec. 17 total
Alabama	4,400		4,400	4,100
Arkansas	73,800	500	74,300	74,750
California	978,800		978,800	978,200
Colorado	157,100		157,100	153,300
Eastern	52,100		52,100	52,100
Florida	1,350		1,350	1,350
Illinois	234,000		234,000	219,800
Indiana	30,000		30,400	29,100
Kansas	338,800		338,800	334,200
Kentucky	40,300		40,300	39,500
Louisiana	713,150	58,200	771,350	769,700
North	115,150	2,200	117,350	115,700
South	598,000	56,000	654,000	654,000
Michigan	30,400		30,400	31,000
Mississippi	107,300	5,050	112,350	112,350
Montana	39,400		39,400	41,300
Nebraska	28,400		28,400	29,100
New Mexico	223,900	4,150	228,050	228,050
North Dakota	33,200		33,200	36,700
Oklahoma	595,000		595,000	590,100
Texas	2,887,000	53,250	2,940,250	2,940,250
Dist. 1	56,000	600	56,600	56,600
Dist. 2	154,000	8,100	162,100	162,100
Dist. 3	414,000	25,200	439,200	439,200
Dist. 4	241,000	5,400	246,400	246,400
Dist. 5	49,000	525	49,525	49,525
Dist. 6	126,500	5,800	132,300	132,300
East Texas field	223,500		223,500	223,500
Dist. 7-B	150,000	50	150,050	150,050
Dist. 7-C	175,000	4,800	179,800	179,800
Dist. 8	992,000	2,000	994,000	994,000
Dist. 9	216,000	575	216,575	216,575
Dist. 10	90,000	200	90,200	90,200
Utah	4,700		4,700	4,500
Wyoming	273,800		273,800	277,400
Others	‡250		‡250	200
Total U. S.	6,847,550	121,150	**6,968,700**	6,947,050
Change from previous week up			**21,650**	
Canada	†406,325		†406,325	‡429,825
Total U. S. production Jan. 1-Dec. 24			2,419,350,850 bbl.	
Same period last year (crude plus cond.)			*2,271,626,886 bbl.	

*Includes 35,155,150 bbl. cond. †Week ended previous Monday. ‡Ind. Nev. 250.

CRUDE-OIL STOCKS

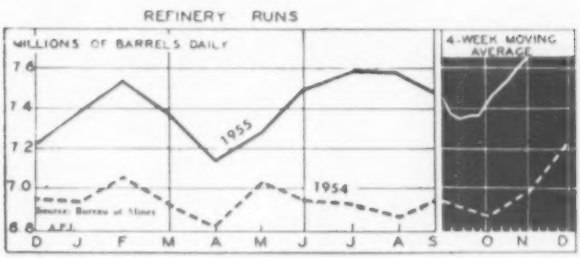


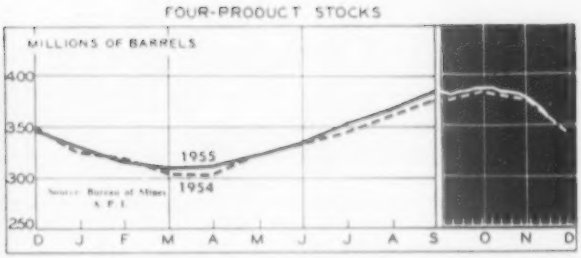
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

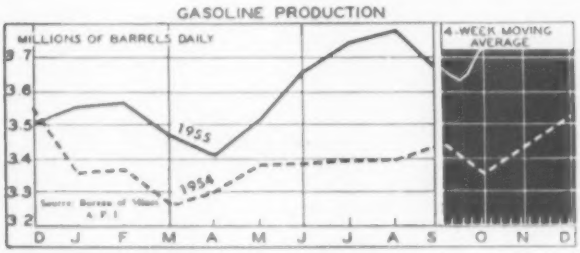
(Thousands of barrels)

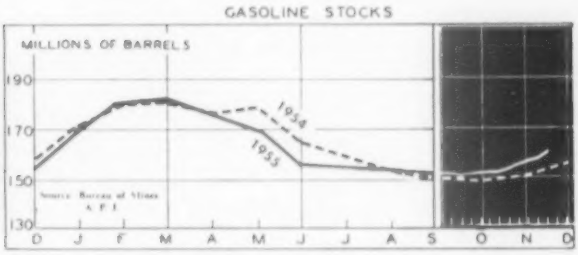
	12-17-55	12-10-55	12-18-54
Pennsylvania Grade	3,014	3,018	3,088
Other Appalachian	2,269	2,253	1,923
Illinois, Indiana, Michigan	9,143	9,404	12,208
Nebraska, North Dakota	2,004	2,124	1,485
Kansas	8,013	7,744	8,540
Oklahoma	21,261	21,245	25,774
Arkansas	2,380	2,528	3,013
Louisiana	16,576	16,358	14,876
North	2,440	2,733	2,441
South	14,136	13,625	12,435
Mississippi	2,612	2,770	2,930
New Mexico	7,537	7,658	8,886
Texas	122,484	121,356	120,807
East Texas proper	9,254	9,094	9,825
West Texas	58,152	57,466	54,444
Texas Gulf	23,756	24,359	23,714
Other Texas	31,322	30,437	32,824
Wyoming	15,249	15,141	13,515
Other Rocky Mountain	6,092	5,706	5,637
California	27,393	27,066	31,661
Foreign	†12,032	12,549	11,150
Total	258,059	256,920	265,493

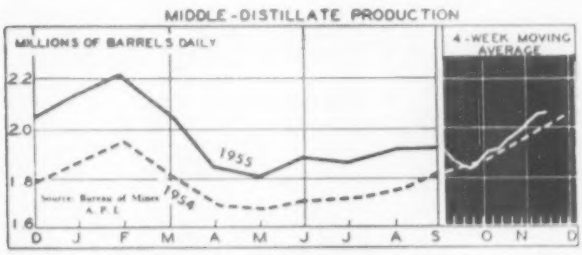
*Bureau of Mines. †Includes 2,419,000 bbl. in California.

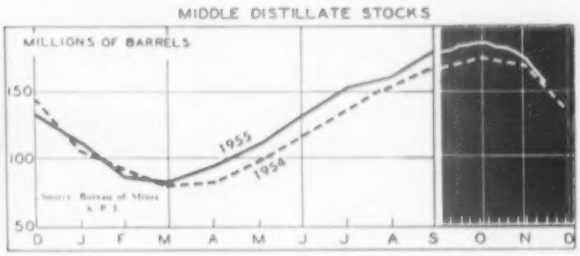


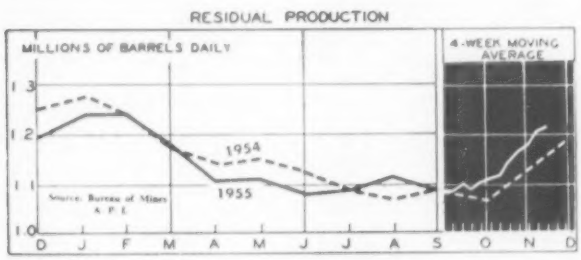


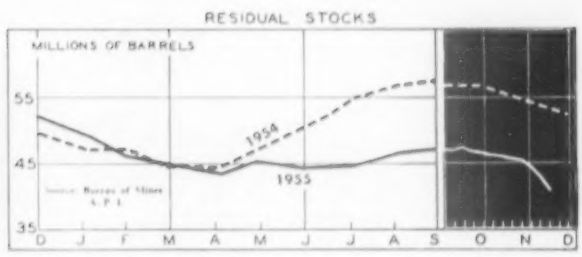

GASOLINE PRODUCTION
MILLIONS OF BARRELS DAILY
4-WEEK MOVING AVERAGE
1955
1954
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D




MIDDLE-DISTILLATE PRODUCTION
MILLIONS OF BARRELS DAILY
4-WEEK MOVING AVERAGE
1955
1954
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D




RESIDUAL PRODUCTION
MILLIONS OF BARRELS DAILY
4-WEEK MOVING AVERAGE
1954
1955
Source: Bureau of Mines A.P.I.
D J F M A M J J A S O N D



A.P.I. REFINERY REPORT, DECEMBER 16

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1954 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,060	453.7	10.6	275.8	224.4	56,054	12,457	47,752	11,267	1,048	426.2	34.3	281.0	249.0
Appalachian:														
District 1	108	43.4	6.7	23.0	8.6	4,552	640	2,638	558	98	40.9	6.4	20.5	9.2
District 2	105	54.1	6.6	16.9	11.9	2,296	398	918	359	75	36.4	6.6	13.2	9.5
Ind., Ill., Ky.	1,473	780.0	85.8	296.7	219.0	33,151	7,001	21,935	3,953	1,341	716.6	78.7	278.2	186.7
Okla., Kans., Mo.	732	426.7	18.7	181.3	30.3	16,398	1,666	12,951	1,440	645	361.7	20.6	167.0	44.3
Inland Texas	252	195.7	5.3	54.6	22.0	5,674	550	2,484	1,323	239	171.5	11.9	46.1	18.3
Texas Gulf Coast	1,880	897.0	134.1	478.7	257.7	21,055	3,051	14,950	6,901	1,797	835.3	139.6	468.0	226.4
La. Gulf Coast	679	344.6	57.3	153.6	56.8	9,248	2,618	6,089	1,361	606	307.4	61.8	159.9	38.9
N. La. and Ark.	93	36.6	8.9	19.1	7.9	4,150	800	2,432	88	88	35.8	9.1	20.5	7.8
Rocky Mountain:														
New Mexico	21	10.9	...	3.3	2.7	253	6	49	29	20	11.6	0.7	3.3	3.0
Other Rocky Mtn.	251	121.6	3.6	58.3	38.9	5,385	297	2,572	760	248	123.6	5.1	59.6	42.3
California	1,030	502.7	9.3	164.0	351.7	22,190	425	11,270	12,896	1,033	448.4	5.7	151.0	351.9
Dec. 16, 1955	7,684	3,867.0	346.9	1,725.3	1,231.9	160,406	29,909	126,040	40,935	7,238	3,515.4	380.5	1,668.3	1,187.3
Dec. 9, 1955	7,618	3,792.3	348.1	1,694.7	1,216.9	158,374	32,005	134,413	42,767					
Dec. 17, 1954	7,226	3,496.9	357.1	1,655.3	1,116.9	151,778	31,936	118,082	52,265					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (86 octane)	11.00-11.25
Premium (94 octane)	12.50-12.75
Gulf Coast (Cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.25
Premium (97 octane)	13.00-13.25
New York (barges):	
Regular (89 octane)	12.25
Premium (96 octane)	14.50
California—Los Angeles:	
Regular (84 octane)	13.10-13.15
Premium (93 octane)	14.10-15.10
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	6.00
Breckenridge:	
Grade 26-70	5.50

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for the more stable grades may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	**9.75-10.00**
Diesel oil (58 d.i. and above)	**9.375-9.50**
Distillate No. 1	**9.375-9.50**
Distillate No. 2	**8.75-9.00**
Gulf Coast (cargoes):	
Kerosine 41-43	8.75-9.00
Distillate No. 2	8.50-9.00
New York Harbor (barges):	
Kerosine 41-43	10.55
Distillate No. 2	10.05
Diesel fuel, 48-52 d.i.	10.35
Caribbean area (cargoes):	
Distillate No. 2	8.50

WAX (LB.)

Oklahoma (Group 3):	
132-134 A.m.p.	6.00
New York (export):	
126-130 crude scale	6.60

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-$2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, D.W.I.	$2.10
California (cargoes):	
Bunker C fuel, Los Angeles	$2.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined 0-10 p.p., 95 v.i.	23
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	19.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22-23
200 vis. neutral (180 at 100°), 25 p.t.	20

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M. (sour)	Wyo.
14-14.9	$1.97				
15-15.9	2.03				
16-16.9	2.09				
17-17.9	2.15				
18-18.9	2.21				
19-19.9	2.27				
20-20.9	2.33	$2.50		$2.37	
21-21.9	2.39	2.52		2.39	
22-22.9	2.45	2.54		2.41	
23-23.9	2.51	2.56		2.43	
24-24.9	2.57	2.58	$2.91	2.45	
25-25.9	2.63	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9		2.76	3.09	2.63	2.50
34-34.9		2.78	3.11	2.65	2.52
35-35.9		2.80	3.13	3.67	2.54
36-36.9		2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, October 17, 1955; east of California, June 15, 1953; Pennsylvania Grade, December 1, 1955.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.60
Middle District	3.47
Southwest Pennsylvania	3.18
West Virginia	3.07
Buckeye Grade	3.01
Zanesville Grade	2.82
Illinois Basin	3.00
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-48.9°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	11.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.92
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.39
Iraq, 36.0°-36.9°, Tripoli, Banias	2.39
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

Gulf-New York, clean (USMC+130%)	$6.56
Gulf-New York, dirty (USMC+115%)	6.13
NWI—U.S.N.H. dirty (USMC+65%)	4.46
Lebanon—U.K., dirty (USMC+42.5%)	7.77

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FOR SALE: Used R. L. Cardwell Drilling-in Unit. Splendid condition with all accessories and large Doghouse. Located near Wichita. Phone or write John Richard, McClelland Hotel, Wichita, Kansas; or write Box 361, Topeka, Kansas.

FOR SALE: 1—Ingersoll Rand 2½" 6 stage Centrifugal Pump on Bedplate. 1—Westinghouse Speed Increaser, Type SU, 150 H.P., 3510 R.P.M. Contact Cooperative Refinery Association, Bartlesville, Oklahoma.

FOR SALE—Near Ponca City, Oklahoma 16,000' 8⅝" OD 28# used line pipe suitable for casing or line pipe. Cities Service Pipe Line Company, Patridge, Bartlesville, Oklahoma.

GARDNER-DENVER two-stage gas compressor unitized unit powered by **250 H.P. Buda motor** and all equipment, gauges and coolers necessary to operate. All in first-class condition. Gulf Southwest Service Co., P. O. Box 1328, Shreveport, La. Telephone 3-8428.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE: ONE NEW 3 Unit Westinghouse Metal Clad Indoor Lift Type Switch Gear, 6900 Volt, 100 Amp., Housing Code A, with one Breaker Oil Circuit Style #18Y9308, Type B-20-B, 600 Amp., 15,000 Volt, 3 Pole, Complete with Current and Potential Transformers, Necessary AC and DC Ammeters, and AC Voltmeters, Powerfactor Meters, Wattmeters, Temperature Indicators, Type CA Differential Relays, Type CO Induction Overcurrent Relays, Type WL Auxiliary Relay, Type SRA Voltage Regulator. CONTACT: L. F. Mayfield, Room 534, Adams Building, Phillips Petroleum Company, Bartlesville, Oklahoma.

NEW TRAILERS

DROP—BED "TYPE" $2,731.48
FLAT—BED "TYPE" 2,638.89
Plus 6% Tax

Built To Order

PASKO MACHINERY & STEEL
1721 CHICAGO DRIVE S. W.
GRAND RAPIDS, MICHIGAN

FOR SALE EQUIPMENT

FOR SALE: 86' Oilwell Mast, with 4½ Substructure. Telephone: CE 2-6318, Oklahoma City, Okla.

PACKAGED GAS COMPRESSORS, 50 to 400 horsepower. New and used. Can be leased or financed. If you have the gas, we have the compressor. M. C. Bolin, Jr., Box 868, Tulsa, Oklahoma. Phone CHerry 2-6291.

HOT OIL PUMPS
Worth, 12" KUF Diesel drive
Nat. Tr. 4x12 HDOEP Duplex
Worth, 9x5x10 Duplex.

TRANSFER PUMPS
Duplex from 4x3x4 to 10x7x12

FURNACE TUBES
4-6% Chrome ½ New Cost

TOWERS—COLUMNS
4'x59' 160 PSI 23 trays.
2'x47' 375 PSI 30 trays.
3'x49' 425 PSI 28 trays.
7'x54' 150 PSI 20 trays.
7'6"x41' 160 PSI Reactor

FURNACES
Crude Oil 8 Million BTU.
Light Oil 10 million BTU.

HEAT EXCHANGERS
94 to 550 sq. ft. Steel Tubes.
140 to 440 sq. ft. Adm. Tubes.

COMPRESSORS
1406 SCFM Gas Driven 250 PSI
211 CFM Motor Drive 100 PSI.

ETHYL BLENDING PLANT
4200 gal. Tank, Scale & Building

STORAGE TANKS
500 to 20,000 bbl. All Welded

BOILERS
153 HP 160 PSI Water Tube (3).
250 HP 150 PSI Stirling.

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60 East 42 Street, New York 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

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FOR SALE: 3400' of 3½" drill pipe, new sleeves, extra good. Telephone: CE 2-6318, Okla. City.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

GASOLINE PLANT EQUIPMENT FOR SALE

3—800# MMCF Absorbers with Scrubbers, etc.
1—30" x 62' Depropanizer with Accumulator, Reboiler and Condenser.
1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.

Other equipment, Instruments, Pumps, Pipe, Valves and Fittings necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

SOUTHERN PRODUCTION COMPANY, INC.
P. O. Box 670, Phone FAnnin 8103,
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SAVE MONEY
on
8" LINE PIPE
LAPWELD 8⅝" O.D. 28.55

Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.

Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi. Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ½ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

Brokers and agents protected.

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6,000 Bbl. Topping—3,000 Bbl. Thermal Cracking, 100 Bbl. Catalytic Polymerization—Lube Oil and Paraffin Wax Plant, Rerun Unit, 8500 Gal. Ethyl Plant, Boiler Plant, Tank Farm, Instruments—Complete Refinery Pipe, Valves, Fittings, etc.—Visit the plant—salesmen on premises.

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Cabin Creek (Suburb of Charleston) W. Virginia
Tel. East Bank 5611—Mail Address P. O. Box 2321
Roy Crisp—Manager—Charleston, West Virginia

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ANOTHER BRILL LIQUIDATION!

FORMER LACY REFINERY

BIG SANDY, TEXAS

COMPLETE POLY UNIT, BUILT 1950

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
3—Absorbers, 14" x 40', 20" x 50', 160#
2—Wash Towers, 18" x 23', 150#
1—Reactor, 24" x 28', 550#
1—Depropanizer, 20" x 35', 450#
1—Debutanizer, 12" x 28', 120#
3—Brinkman vertical tube furnaces 2, 1¼ mil. BTU/hr.
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
3—Adm. heat exchangers 424, 346, 176 sq. ft.
2—Perco reactors 4500 gal., 8' x 12', 347 stls. st. 120#, 1000° F.
1—5' x 90' tower, 40 tray, 135# WP
1—7' x 30' Propane tank, 250# WP
1—10' x 50' Crude tower, 18 trays
1—6' x 34' Vacuum tower, 150#
1—2' x 50' tower, 24 trays
3—Welded tanks, 10' x 40', 10' x 30', 5' x 20'
3—St. exchs., 2000, 1500, 480 sq. ft.
9—Oilfield boilers, 125 hp., 275#
1—Ethyl lead plant
3—Penn. comp. 8 x 11 x 9, 12 x 11½ x 13, 10 x 8 x 11
2—Convection furnaces, 4-6 ch tubing
1—Vapor phase cracking furnace
30—Welded storage tanks, 5000, 2000, 1000, 500 Bbl.
1—Waukesha anti-knock machine
8—Hi-vol pumps, 10 x 7 x 18, 10 x 8 x 12, 6 x 4 x 12, 6 x 3 x 8
30—Duplex piston pumps, all sizes
1—10' x 30' asphalt still
6—Steel Bldgs., 30 x 150, 12 x 20, 20 x 40, 20 x 20.
2—Pritchard cooling towers, Adm. Bentube exchanges
1—BS&B Oil & gas separator, 10-7 mcf, 3500 Bbl./day.

COMPRESSOR STATION—BALT., MD.

3—600 hp IR KVG Gas Comp.
1—MWK 2400 sq. ft. adm. exch. 150#

FINAL LIQUIDATION, LEVELLAND, TEX.

6' x 58' ch lined tower, 50#, 21 tray
5' x 40' ch lined vessel, 90#
30,000 ft., 4, 6 in. pipe
5,000 ft. 2", 4", 4-6 ch pipe

EQUIPMENT ELSEWHERE

COLUMNS

7' x 115' 50 tray
8' x 75' 25 tray 40#
2' x 60' 35 tray 560#

HEAT EXCHANGERS

6—Adm. 785, 742, 425 sq. ft.
3—St. 2000, 785 sq. ft.
30—Atmospheric Bentube exch., stls and Adm. 715, 470 sq. ft.
30—304 SS shell & tube condensers 100-1000 sq. ft.

MISCELLANEOUS

Lab Petro-chem furnace 50,000 BTU/hr.
Gould 4" Pump 400 gpm 1600' hd.
B-J hot oil pump 3 x 9, 13 st. 325 gpm, 4620' hd.
Gould 16" pump 10,500 gpm, 135' hd.
Tremendous selection stainless steel and steel valves ⅛" - 6"

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BRILL EQUIPMENT COMPANY

4101 San Jacinto St., Houston 4, Texas, JA 6-1351
Or
2401 Third Ave., New York 51, N. Y., CYpress 2-5781

FOR SALE EQUIPMENT

FOR SALE—3 R. L. Cardwell Double Drum Spudders, each with a 4-legged mast and sub-structure. All in excellent condition. Priced to sell. Box 871, Seminole, Okla.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FAILING 1500 heavy duty drill with 4½ x 8 pump, automatic pulldown, and mounted on Ford truck. Write P. O. Box 819, Longmont, Colo. Phone 1333.

FOR SALE EQUIPMENT

FOR SALE—At Bartlesville one Mayhew 1000 Rotary Shot Hole Drill, mounted on Ford 1½ ton Coleman Drive unit with 4½" x 6" pump and 22' mast. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

NEW PIPE FOR SALE—Approximately 24,000 feet of 1½ inch hydril C. S. joint upset tubing. Pipe located in our yard at Harleton, Texas, sixteen miles northwest of Marshall, Texas. Price F.O.B. our yard $1.25 per foot which price is cheaper than expense of fabrication. Also three new Cameron christmas tree head assemblies for 3,000 lb. w.p. Price $925.00 each. D. E. & R. J. Whelan, ph. 5-3162, Marshall, Texas.

FOR SALE ALL STEEL STORAGE TANKS

6—17,500 bbl. ea. CBI pontoon floating roofs; 4—80,000 bbl. cone roofs; 1—same breather roof; 10—55,000 bbl. cone roofs will cut down matchmark or reerect on customers grade. Wire, phone or write. DI 3-6141.

W. C. Berry,

P. O. Box 1858, Tulsa, Okla.

ANOTHER LARGE AUCTION

Quitting Business

CLARK BROTHERS WELL SERVICING—AND—
OKLAHOMA WELL SERVICING COMPANY

Located: Highway 77, North of City Limits—PAULS VALLEY, OKLA.

Beginning: Thursday, January 12, 1956—11:00 A.M. (CST)

We are authorized by Mr. Rufus Clark, owner of Clark Brothers Well Servicing Company and Oklahoma Well Servicing Company, to sell to the highest bidder, regardless of price and without minimum or reservation, these two Well Servicing Companies. This is the first time a complete Well Servicing Company has ever been offered at auction.

Inspection Date: January 8th till time of sale.

List of Equipment as Follows:

1954—212 Int. Tandem, Propane, w/Mdl. 658 Double Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools & ⅝ Inch Swabbing Line.
1954—192 Int. Tandem, Propane, w/Mdl. 44 Double Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools & Approx. 7000 Feet of ⅝ Inch Swabbing Line.
1953—192 Int. Tandem, Propane, w/Mdl. 65 Double Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools & ⅝ Inch Swabbing Line.
1953—192 Int. Tandem, Propane, w/Mdl. 65 Double Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools & Approx. 8000 Feet of ⅝ Inch Swabbing Line.
1953—210 Int. Tandem, Propane, w/Mdl. 658 Double Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools & ⅝ Inch Swabbing Line.
1950—Int. Tandem, Propane, w/Brownlipe Transmission, Mdl. 65 Single Drum "Franks" Well Servicing Unit, 13⅜ Inch to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave equipped w/Rod & Tubing Tools.
1949—KB8F Int. Tandem, Propane, w/450 Mtr. equipped w/Mdl. 658 Single Drum "Franks" Well Servicing Unit, 10¾ Inch to 8⅝ Inch 65 Ft. Telescoping Pole, Single Sheave Crown & Cross Sheave, 11,000 Feet of ⅝ Inch Swabbing Line & Swabbing Tools.
1948—KB8F Int. Tandem, Propane, w/401 Mtr. equipped w/Mdl. 65 Single Drum "Franks" Well Servicing Unit, 10¾ Inch to 8⅝ Inch 65 Ft. Telescoping Pole, Single Sheave Crown & Cross Sheave, 9000 Feet of ⅝ Inch Swabbing Line & Swabbing Tools.
1946—K-11 F Int. Tandem, Gasoline, w/Mdl. 5000 "Franks" Well Servicing Unit, 10¾ to 8⅝ Inch 65 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave w/Rod & Tubing Tools.
1946—K-11 F Int. Tandem, Propane, w/Mdl. 5000 "Franks" Well Servicing Unit, 10¾ to 8⅝ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave w/Rod & Tubing Tools.
1942—K-10 F Int. Tandem, Propane, w/Mdl. East Texas Super "Franks" Well Servicing Unit, 13⅜ to 10¾ Inch 68 Ft. Telescoping Pole, 3 Sheave Crown & Cross Sheave, Approx. 9000 Feet ⅝ Inch Line, Rod & Tubing Tools.
1951—LF-174 Int. Tandem Road Truck w/Fifth Wheel, Leland Oil Field Bed, Headache Rack, Braden Winch & Brownlipe Transmission.
1954—Ford F-6 Oil Field Bed, Tulsa Winch, 2-Speed Rear-end, 3-Speed Brownlipe & Power Tower.
13 Pickup Trucks. All Equipped w/Heavy Duty Rear Bumpers & Tool Boxes.
2—1953, F-100 Fords, 4-Speed Transmission; 1—1951, F-1 Ford; 4—1950 F-1 Fords; 3—1949, F-1 Fords; 2—1953 F-1 ords & 1—1953 Int. Pickup.
3 Sets of BJ Powermatic Air Tubing Tongs, Trailer Mounted w/Waukesha Motor.
2 1955 Ford Customline 2-Door Passenger Cars; 1—1955 Ford Mainline 2-Door Passenger Car.
1 Single Axle Shopmade Pole Trailer w/Budd Wheels.
Buildings: 25 by 35 Ft. Pipe Frame, Sheet Iron Shop Building; 18 by 20 Ft. Frame Tool House.
Miscellaneous Equipment: 1—Int. 450 Motor, Rebuilt; Steam Cleaner; Air Compressor; Hydraulic & Floor Jacks; 10—New Truck Tires 10.00 x 20; Several New Pickup Tires; Allis-Chalmers Motor; New Set Rig Lights; Swabs; Break-in Motor Stand; Battery Charger; Hundreds of Dollars Worth of U-Joints & Timken Bearings; Nuts & Bolts; Clutch Diaphragm; Several Budd Wheels; Drill-Press; Paint Spray Equipment; Drop Lights; Misc. Tools & Many More Items Too Numerous to Mention.

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FOR SALE EQUIPMENT

FOR SALE: Walker-Neer C-37 Cable Tool Rig fully equipped and ready to work to 8500 feet. For further information and complete inventory of tools please call or write Big State Tool Company, P. O. Box 2024, Phone 7-3052, Odessa, Texas.

FOR SALE: 2 Type 80 Cooper Twin Gas Engine Driven Compressors rebuilt like new ready to go. Compressor Cylinders to suit. $4,500.00 each. Write or phone W. S. Smith, 205 Thompson Bldg., Tulsa, Okla. LUther 2-5473.

EQUIPMENT WANTED

MAYHEW 1000 with 5x6 Wheatley Pump and equipped for 15' drill rods. 750 gal. class water truck. Trucks should be of late model. TEXAS SEISMOGRAPH COMPANY, Box 2069, Wichita Falls, Texas.

LEE C. MOORE 94' or 96' Jackknife Mast and substructure which can be extended to 126' or 127' mast. What I am in the market for is a 126' or 127' mast and substructure. Must be in A-1 Condition. Will pay cash. Conroe, Texas, Telephone: Pleasant 6.2554. J. C. Foretich, Foretich Well Service.

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co. Box 2603, Tulsa, Okla. $5.00 cash.

WANTED IMMEDIATELY: Engineer; two or three years experience, for drilling production and reservoir work in Midwest area. Salary commensurate with training and experience. Write Box J-294, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS CONTRACTS MAN—Large mid-continent integrated oil company needs gas sales and contract man with at least 5 years experience in marketing natural gas. Must be experienced in negotiating gas sales contracts and be familiar with potential gas markets in mid-continent and Gulf coast areas. Location, Tulsa, Oklahoma. Our employees know of this ad. Submit experience, qualifications, education, age, and minimum salary requirements to Box J-305, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER

Excellent opportunity with expanding engineering and construction organization for graduate chemical or petroleum refinery engineer. Preferably, the man for this position should have three to five years experience in process design, plant process operation or plant process control.

This is a **position with responsibility.** Our Process Engineers make the basic process design on a unit, and then follow the unit through mechanical design to plant start-up by assisting other departments as the job progresses.

Work **assignments are varied.** The process engineer is given the opportunity to design all types of units from cat crackers to treating plants, and is encouraged to keep abreast of the latest developments in petroleum processing.

Refinery Engineering Company engages in the design and construction of all types of petroleum refinery units and is currently expanding into the chemical and related fields.

Send complete personal information including salary requirements.

Chief Process Engineer

REFINERY ENGINEERING COMPANY

P. O. Box 1558

Tulsa, Oklahoma

Phone LUther 4-3461

HELP WANTED

SEISMOGRAPH Computer. Must be experienced and free to travel. Box J-234, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT OIL COMPANY wants Geologist with minimum of three years experience, North and West Central Texas. Should be familiar with all phases of petroleum geology and land work. Submit complete resume and photograph, indicating education, experience and salary requirements. Our employees are aware of this ad. Box J-291, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER

A large Engineering and Construction Co. now building a very large Oil Refinery on the East Coast desires an Engineering Graduate with at least 5 years' oil refinery supervisory operating experience. This engineer is to assist construction crews in coordination of job completion.

Submit resume and salary requirements to

BOX J-302,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEERS

Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-300,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SEISMOLOGIST WANTED

Excellent opportunity with unlimited future for seismologist to organize, supervise and direct geophysical operations of the Natural Gas and Oil Company, a division of the Mississippi River Fuel Corporation, within the Louisiana Gulf Coast and offshore areas. Age 35 to 45 years, minimum of 8 years petroleum exploration experience, including two years South Louisiana experience. Apply in writing giving details. All inquiries strictly confidential. Address:

Personnel Manager
Natural Gas and Oil Company
215 Richards Building
New Orleans, Louisiana

DIVISION GEOLOGIST

Aggressive independent oil company has opening in its Tulsa Office for top sub-surface geologist under 40 who has had past experience in Oklahoma. Do not apply unless you are qualified and have major oil company training. Excellent position for right party. In replying, give past employment record, educational background, etc. All replies handled strictly confidential. Reply

Box J-306, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

GEOLOGIST

Opening January 15 with active independent for geologist with 2 to 3 years experience in Oklahoma. Reply should include full details of qualifications, education, and past employment.

Box J-272,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEER

Major Midwest Bank

has opening for man experienced in valuation of oil and gas reserves. In reply please give resume of experience and salary expected. All replies held confidential.

Box J-275,
The Oil and Gas Journal,
Tulsa, Oklahoma.

DRILLING EQUIPMENT ENGINEER

Foreign Service

With degree in Petroleum or Mechanical Engineering, plus minimum of 5 years experience in the design, manufacture, use and maintenance of drilling equipment and supplies. Must have drilling operations experience and knowledge of the various drilling equipment manufacturers and their products. Salary dependent upon experience and qualifications.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

Recruiting Supervisor, Box 74

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE, NEW YORK 22, NEW YORK

SITUATIONS WANTED

LANDMAN—Employed, 4 years Major, Rockies; Titles, Leasing, Joint Ventures, Units, Personnel. Veteran with B.A. and L.L.B. Seeking challenge with independent or small company. Box J-293, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN OR MANAGER. Land department. Experience with major company includes 3 years leaseman; 6 years accounting; 5 years industrial relations supervisor. College Graduate. Age 38. Will relocate. Victor Grant, 2740 W. Jefferson Blvd., Dallas, Tex.

EXECUTIVE Assistant to president, officer in charge of crude oil operations and office, employed. 11 years diversified experience Midcontinent and Tristate areas. Will consider salary or interest deal with corporation or individual. Box J-295, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERING—SALES

Petroleum Engineering degree, 1951. Mechanical aptitude. Five years commission selling oilfield specialties. Three years as engineer for centrifugal pump manufacturer. Three years field experience with geophysical party. Age 36, married, family, consider any location.

Box J-296, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PRODUCTION GEOLOGIST. Fifteen years' experience in various phases of oil business in the United States, Canada, South America. Currently senior geologist with major company in South America. Desires connection with future, with organization having active development program. Foreign or domestic. Geologist or Petroleum Engineer. Box J-304, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, Age 31, with 5 years Mid-continent experience, desires position with newly organized or established independent oil company. Box J-303, The Oil and Gas Journal, Tulsa, Oklahoma.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY

P. O. Box 1628, Hobbs, New Mexico
Phone 3-3141
146 Allen Building, Midland, Texas
Phone 2-2962

ROYALTIES

WANTED: Producing Royalties by Principal. Submit, Engineer's report—Run tickets and Price. R. M. Sims, P. O. Box 447—Phone 1024, Crockett, Texas.

LEASE AND DRILLING BLOCKS

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

S.E. KANSAS Waterflood Prospect. 917 Acres. Old gas well logs show up to 36' Bartlesville sand under 450'. Floods adjacent. J. S. Newbrough, Ph. 6313, Box 251, Bartlesville, Oklahoma.

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited
B. D. BUCKLEY
8635 Delmar Ave., St. Louis, Mo.

FARMS AND RANCHES

VIRGINIA ESTATE

Looking for a farm near Washington, with redecorated 12-room home and every convenience? Orange County Hunt has met on my place for years, and there are foxes galore. Only fifty miles from Washington on side road in Bull Run Mountains near Middleburg. 340 acres, in whole or part, with or without house. Sale by owner.

Box J-299, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

OFFERING CHOICE PRODUCING oil and gas income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

GENIE PETROLEUM, INC.

GRAND JUNCTION, COLORADO

CORPORATION WELL #1

Offering 48 1/64ths Working Interests.

These 1/64th Working Interests are in CORPORATION WELL #1 to be drilled in Garfield County, Utah.

Write for Offering Circular.

GENIE PETROLEUM, INC.,

460E WHITE AVENUE.

GRAND JUNCTION, COLORADO.

WANTED

OIL PROPERTIES WANTED. "Oil properties wanted, settled or semi-settled production of 100 to 2,500 barrels daily in Oklahoma and Kansas. Property must stand thorough inspection. Contact Morris Sitrin 1215 First National Building, Tulsa, Oklahoma with particulars.

PRODUCTION

200 BARRELS DAILY. Have approximately 200 barrels settled production Creek, Payne, Lincoln County, Oklahoma for sale immediately. Have net interest 20 wells under total 35. Income approx. $15,000.00 monthly gross. References please. Box J-301, The Oil and Gas Journal, Tulsa, Oklahoma.

LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, January 24, 1956 and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah, for the leasing of 64,276.07 acres of Tribal land and 1,198.52 acres of Reserved land in 27 separate parcels, located in Townships 1 and 2 North, Ranges 1 East and 1, 2, 3 and 4 West, Uintah Special Base and Meridian Survey, Uintah and Duchesne Counties, Utah, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to Mr. John O. Crow, Superintendent of the Uintah and Ouray Agency, Fort Duchesne, Utah or to the office of the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware.

BUSINESS OPPORTUNITIES

PARTIES WANTED to help me drill a well for Oil and Gas on 160 acre lease, on which there was a well drilled in 1916 and they got a good well but for some reason it was plugged. Let me tell you all about this lease and well. Write O. A. Sewell, P. O. Box 103, Coweta, Oklahoma.

Am interested in leases or blocks for drilling purposes if information will justify. Depth preferred from 1000 to 4000 ft. Also good royalty.

Write or Call
R. E. (BUCK) CLEMENT
Box 55—Ph. 26 or 84
Norman, Oklahoma.

LEGAL

Sealed bids will be received until 2:00 P. M. Monday, January 16, 1956, and opened at that time at the Pawnee Area Field Office, Pawnee, Oklahoma for the leasing of allotted lands located in Kay, Noble, Pawnee and Payne Counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. John L. Johnson, Area Field Representative of the Pawnee Area Field Office (phone 985).

Equipment Men

Worthington Makes Laramy Assistant Sales Manager

J. B. LARAMY

John B. Laramy is appointed assistant general sales manager of Worthington Corp., according to an announcement by Thomas J. Kehane, vice president in charge of sales. He also announced the appointment of Alvin F. Welsh as manager of the marketing research department.

Laramy joined Worthington in 1929. Upon completion of the student training course, he was assigned to the company's Chicago district office where he served as an application engineer, general line salesman, and assistant district office manager. In 1951 he became manager of the marketing research department.

Welsh joined Worthington in 1925 as an application engineer at the Tulsa office. He subsequently served at various district offices as a general line salesman until 1924. He then joined the Reciprocating Pump Division and in 1948 was promoted to manager of that division.

Bovaird Supply Co. Reelects Officers

Bovaird Supply Co. recently held its annual stockholders meeting in Tulsa and has reelected the following directors and officers as the firm enters its eighty-sixth year: Davis D. Bovaird, president; Roscoe G. Ayers, vice president and general manager; R. E. Batchelor, vice president and sales manager; R. M. McMahan, secretary and purchasing agent; T. H. Trower, treasurer; and M. B. Parks, assistant secretary and assistant treasurer. W. J. Bovaird, general manager of stores, was elected to the board of directors.

Pres. Davis D. Bovaird, past president of P.E.S.A. and prominent in oil-industry and civic activities, reported on a successful year. Other officials reporting at the meeting were Ayers, McMahan, William J. Bovaird and Trower.

District managers attending the meeting included: F. J. Robbins, Oklahoma territory; F. H. Rudrauff, Illinois; R. W. Robbins, Kansas; R. E. Whitten, Texas Panhandle; and J. A. Kennedy, West Texas and New Mexico.

Chiksan-Weco to Build New Plant in Houston

The Well Equipment Manufacturing Corp., an operating division of Chiksan Co., has announced plans for a new plant to be constructed in Houston. The expansion will provide Chiksan customers with a second manufacturing source for Chiksan swivel joints and flexible line assemblies, as well as increased production of Weco products. The Weco division's present Houston plant manufactures a complete line of wing unions, snatch blocks, and other specialty items for the petroleum industry.

The new plant will occupy 18 acres and will consist of a 64,000-sq.-ft. shop, several smaller production buildings, and an office building. These facilities will more than double the size of Weco's present operations. Completion is scheduled for the middle of 1956.

Couch to Manage Stationary Compressor Sales for Le Roi

E. R. COUCH

The Le Roi Division of Westinghouse Air Brake Co., Milwaukee, Wis., has appointed Edward R. Couch manager of stationary compressor sales. His appointment was announced by Jack E. Heuser, general sales manager for Le Roi. Couch's new duties include planning stationary compressor sales, assisting in promoting a strong distributor sales and service program, and assisting field personnel on special applications.

Prior to joining Le Roi in 1954 as an assistant product sales manager, Couch was with Industrial Products Division of Westinghouse Air Brake Co., which at that time manufactured the stationary compressors now made by Le Roi.

Welex Jet Names Two Sales Engineers

R. O. Linville and Percy L. Hall have been appointed sales engineers for Welex Jet Services, Inc., at Pampa, Tex., and Wichita, Kans., the oil-well service company has announced.

Linville, who has worked on the wells or with service companies for over 6 years, has been with Welex for 2 years. He worked as a rigger and a shooter with the company before going into sales work.

Hall, who has had 24 years experience in oil-well service work, has served as production superintendent, field superintendent, unit operator, and drilling superintendent with both major and independent oil companies.

Security Engineering Forms Gulf Coast Division

A. M. (Bert) Birnie, vice president and sales manager of Security Engineering Division, one of the Dresser Industries, announces the formation of a new Gulf Coast division. Clarence A. Strait will head the new division offices at Houston. The division is subdivided into two districts with Gregg White heading the Security Houston district as district sales manager, and L. M. Bracewell, Jr., as district sales manager for the Security Lafayette district.

Branch offices for Security, manufacturer of drilling bits, reamers, hole openers, casing scrapers, and stabilizers, will continue branch offices in the division at Houma, La., and at Beaumont and Bay City, Tex.

LEGAL

By virtue of, and in conformity with the provisions of Chapter 2, Title 30, of the Louisiana Revised Statutes of 1950, as amended, sealed bids will be received at the office of the School Board of Iberville Parish, Plaquemine, Louisiana, on or before the 10th day of January, 1956, at 2:00 p.m., for the lease of sulphur, potash, oil, gas and/or liquid or gaseous hydrocarbon mineral rights in and to the following described tract, to-wit: All of Section 16, Township 11 South, Range 12 East, containing 665.20 acres more or less, Iberville Parish, Louisiana. All bids to offer a cash bonus for a lease having a primary term which shall not exceed three years. Minimum royalties shall be one-eighth (1/8th) of all oil produced and saved; one-eighth (1/8th) of all gas produced and saved or utilized; two dollars ($2.00) per each long ton on sulphur produced and saved; ten cents (10c) per ton for all potash produced and saved; one-eighth (1/8th) of all other liquid or gaseous hydrocarbon minerals produced and saved. Should lessee fail to begin the actual drilling (spudding in) of a well on the lease premises within one year from the date of the lease, the lease shall terminate as to both parties to the lease, unless on or before each anniversary date lessee shall pay a delay rental (which shall in no event be less than one-half of the bonus offered), which shall cover the privilege of deferring drilling operations for a period of one year. Upon like payments annually, drilling operations may be further deferred for successive periods of one year each during the primary term. The primary term of the lease shall be three years. The lease shall provide for the drilling of offset wells where necessary to protect the School Board's interest and shall contain the provision against the assignment of sublease of the lease unless approved by the School Board. The lessee shall have the right to enter into pooling or unitization agreements with respect to development of the lease premises subject to the approval of the School Board. Certified check, payable to SCHOOL BOARD OF IBERVILLE PARISH, for the full amount of the cash bonus shall accompany and be deposited with each bid and no bid or deposit may be thereafter withdrawn or cancelled; and the cash bonus thus deposited shall be forfeited to the School Board by the successful bidder in the event said bidder does not enter into the writtin contract within TWENTY (20) DAYS AFTER THE WRITTEN LEASE IS SUBMITTED TO HIM FOR EXECUTION. The School Board reserves the right to reject any and all bids and to grant a lease on any portion of the tracts advertised for a price not less than proportionate to the best bid offered for the lease on the entire tract. SCHOOL BOARD OF IBERVILLE PARISH, STATE OF LOUISIANA, BY: Walter Marionneaux, Jr., President; L. G. Hoffman, Secretary.

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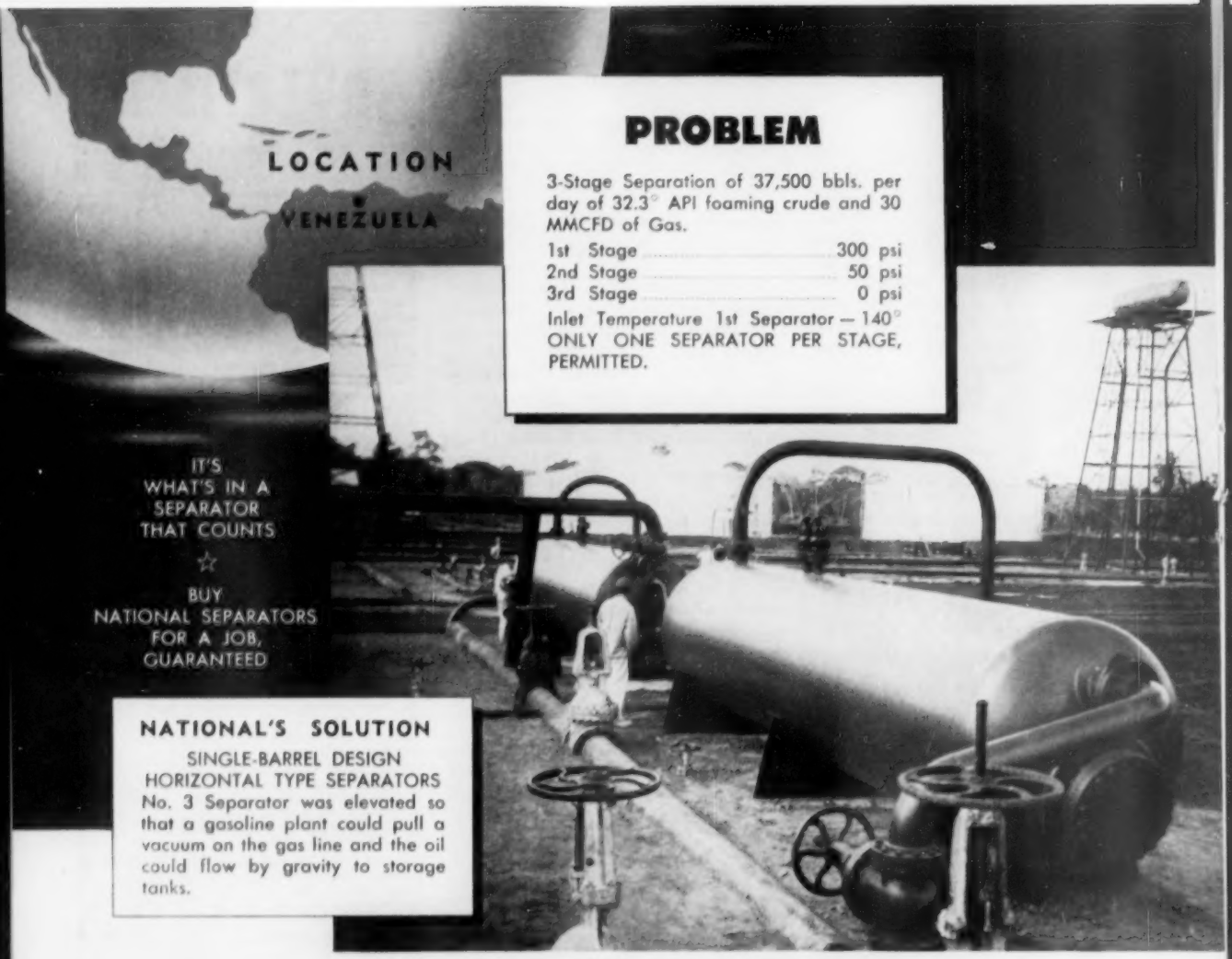

PROBLEM

3-Stage Separation of 37,500 bbls. per day of 32.3° API foaming crude and 30 MMCFD of Gas.

1st Stage	300 psi
2nd Stage	50 psi
3rd Stage	0 psi

Inlet Temperature 1st Separator — 140°
ONLY ONE SEPARATOR PER STAGE, PERMITTED.

IT'S
WHAT'S IN A
SEPARATOR
THAT COUNTS

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NATIONAL SEPARATORS
FOR A JOB,
GUARANTEED

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SINGLE-BARREL DESIGN
HORIZONTAL TYPE SEPARATORS
No. 3 Separator was elevated so that a gasoline plant could pull a vacuum on the gas line and the oil could flow by gravity to storage tanks.

NATIONAL FURNISHED SEPARATORS WITH THE FOLLOWING SIZES AND OPERATIONAL CAPACITIES

	Press. on Separator psi	Bbls. oil per day	Std. Cu. Ft. Gas Per day
No. 1 Separator — 5′ x 22′-6″ long	300		22,700,000
No. 2 Separator — 5′ x 22′-6″ long	50		7,200,000
No. 3 Separator — 6′ x 20′ long	0	37,500	194,000
TOTALS		37,500	30,094,000

Had only one stage of separation been utilized at 300 psi, over 7,000,000 cu. ft. per day would have been liberated in the stock tanks.

It's National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

FREFLO

New DOWELL product breaks water block to open producing formation

Tiny water droplets can kill or cripple oil and gas production when they lodge in the microscopic passages of the formation. Freflo*—another new product developed by Dowell—is helping operators throughout the oil country to break this troublesome water bottleneck.

Freflo is a mixture of several oil-soluble chemical agents. These agents are designed to: reduce the surface tension of the water, lower the interfacial tension between the water and the oil, and break or prevent emulsions. Also, Freflo has proved effective for dissolving asphalt and paraffin deposits.

You'll find Freflo is easy to apply and requires no special well equipment or preparation. Just mix Freflo with diesel oil or fresh, high-gravity crude, then pump the solution into the formation. Or, if you wish, Dowell will do the job for you. One 10-gallon drum of Freflo will make 1000 gallons of treating fluid. The average treatment consists of about 20 gallons of Freflo in 40 to 48 barrels of oil.

Ask for Freflo in 10-gallon steel drums at any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Department A-11.

*A Trade-mark of Dowell Incorporated

services for the oil industry

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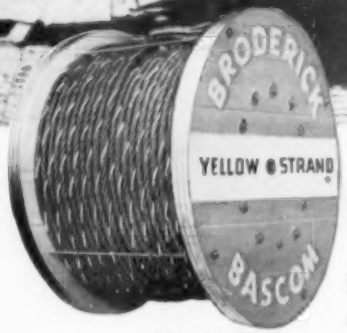

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